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THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station, Beltsville, Maryland
Volume 33, January 15, 1949, Number 1

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ASSOCIATION OF DEUTEROPHOMA SPP. WITH A CHRYSANTHEMUM STUNT DISEASE IN CALIFORNIA

Kenneth F. Baker, Lily H. Clark, and Marston H. Kimball

During investigation of a hollow-stem condition of chrysanthemum cuttings in California, and its possible relation to rot and slow rooting in the propagating bed, a Fusarium[1] and two undescribed Deuterophoma species[2] frequently were isolated. One of the latter fungi occurred commonly in plants unaffected by hollow-stem, but showing symptoms closely resembling stunt disease (1, 2, 3, 7, 14, 15).

Only two Deuterophomas have been reported as vascular parasites, D. tracheiphila Petri on citrus, and D. ulmi (Ver. & May) Goid. & Rugg. on elm. The common occurrence of another fungus of this type in the vascular elements of a plant is, therefore, of pathological interest. The quantity of mycelium found in many of the diseased chrysanthemums could only be associated with host injury, but whether the disease produced is the same as stunt of eastern chrysanthemums is not yet determined.

Since 1946 the chrysanthemum stunt disease has become generally important over the United States in commercial outdoor and greenhouse plantings. It causes reduction in plant height, flower size, and red flower color, and hastens flowering by about 7 to 14 days. No definite causal agent has yet been found, but it generally is considered to be a virus. Because of the importance and obscure nature of stunt, and the undetermined but plausible relationship of Deuterophoma to it, our preliminary observations are made available to floricultural pathologists at this time rather than after inoculation tests that may require several months.

Occurrence of the Fungi

The type 1 fungus is isolated readily from heavily infected plants and generally is obtained in pure culture. In the case of plants slightly or only recently infected it is more difficult to recover the fungus, perhaps because of its restricted development in the tissues.

CALIFORNIA - Plants were collected for culturing from eleven commercial and private outdoor plantings in Los Angeles and San Mateo Counties. The cuttings for some of these had been received from eastern propagators this year. Others represented plant divisions, root suckers, or rooted cuttings from local stock. In the plantings sampled there were numerous short, precociously flowering plants entirely comparable to stunt specimens observed by the senior author in eastern

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[1] Identified by Dr. W. C. Snyder as F. roseum Lk. emend. Sny. & Hans.
[2] Generic identification confirmed by Dr. G. Goidànich.

plantings during the fall and winter, 1947-48. The irregularities of plant height which may result under California field conditions from the use of divisions or root suckers instead of cuttings, and from variation in pinching and disbudding practice, make the symptom picture somewhat less positive than in eastern greenhouses. Considering this variability, there was a constant association of type 1 Deuterophoma with stunted plants. Our observations on this have been confirmed by several pathologists at the University of California, Berkeley, with stunt plants from San Mateo County. Occasionally we obtained the type 1 and/or type 2 fungus from apparently healthy plants in varieties or fields where the disease was present. These may represent incipient or low-grade infections, an interpretation supported by the smaller amount of mycelium observed in microscopic sections of such plants, as contrasted with stunted ones.

Examination of sections cut by freezing microtome and stained with lactophenol-cotton blue showed abundant mycelium in the stems of stunted plants at all points up to the base of the flower. The mycelium was present in phloem and xylem, and in less quantity in the cortex. Invasion of the pith occurred in limited areas adjacent to the points of infected xylem. The phloem was most heavily invaded and was also reduced in quantity, consisting sometimes of only a double row of cells between the pericyclic fibers and secondary xylem. Cambial activity definitely was impaired. In some cases the large quantity of mycelium and the reduced phloem volume produced essentially a girdle of the stem, a condition that would be expected to induce precocious flowering, stunted growth, and retarded rooting of cuttings.

Both type 1 and 2 fungi have been recovered from roots of stunted plants by holding them in a moist chamber for a few days. The fungi grew out of diseased roots, type 1 forming pycnidia in aerial mycelium, and type 2 forming them embedded in the cortex. Short lengths of stems of the variety Meteore that were heavily infected with type 1 fungus, submerged in sterile distilled water for two weeks, developed many superficial pycnidia on the surface of the epidermis; these produced an abundance of normal spores.

Plants from areas free of stunt were found to have no vascular mycelium except of Verticillium, a point determined by culturing. Occasional healthy-appearing plants among stunted ones showed some Deuterophoma mycelium in the upper stem, but the quantity was substantially less than in stunted plants. This suggests that there may be a quantitative relationship to disease production rather than a clear-cut infected or non-infected status.

In order to conduct inoculation studies with these Deuterophomas, extensive search has been made for uninfected plants.[3] Some infection

[3] It is a pleasure to acknowledge the assistance of Mr. R. H. Sciaroni, Assistant Farm Advisor, University of California, San Mateo County, in this search. Mr. I. J. Campbell, Deputy Agricultural Commissioner, San Mateo County, has also supplied materials for test.

was present in all commercial California lots indexed. However, two clean plantings in relatively isolated private gardens in Los Angeles County have been found into which no new stock has been introduced for several years. It is significant that these plants, free of type 1 Deuterophoma and only a few with type 2, were also free of stunt. Several other stocks, isolated for periods up to 25 years, are currently being indexed.

These Deuterophomas may sometimes be associated with the hollow-stem condition. Breakdown of the pith in the growing plant apparently may result from excessively rapid growth, frost injury, and probably other conditions. When the shoots are made into cuttings, the hollow ends of the cuttings fail to callus over, leaving the pith cavities exposed to infection by various organisms, including Fusarium roseum and these Deuterophomas. Infection may occur through the unhealed surface in the cutting bed, perhaps from spores acquired in the hormone solution into which cuttings are dipped.

EASTERN STATES - Specimens of stunt were obtained from a greenhouse planting in Chicago, Illinois. Cultures from the stems of these plants yielded type 1 Deuterophoma in one case and type 2 in another. Similar specimens from Barberton, Ohio, were cultured and yielded the type 2 fungus. An extraordinary amount of Rhizopus and Mucor from the packing material in this second shipment greatly reduced the effectiveness of the indexing of this stock.

These observations establish the fact that the chrysanthemum Deuterophomas are widely distributed in this country, but supply no evidence of their relationship to stunt.

The Fungi

Single-spore cultures of these phomacecus fungi have demonstrated that they fall into two distinct and stable types. Both organisms are undescribed Deuterophoma spp. and may briefly be characterized as follows:

Type 1 - This fungus occurs in the vascular elements extending from the roots to the base of the flower, and is at present regarded as a probable pathogen.

This is the slower growing of the two organisms, forming a colony about 2 cm. in diameter from a single spore on potato dextrose agar at laboratory temperature in 15 days. The colonies are dark gray to black, sometimes produce a diffuse yellow pigment in the agar, have conspicuous, irregular, feathery, white margins, and are composed of firm compact mycelium that develops into a thick layer. Pycnidia are inconspicuous until exudation of spores begins. Occasionally there is a yellowish-

green surface growth on the colonies prior to pycnidial formation, and in this are found many endoconidia typical of the genus. Single-spore cultures develop mature pycnidia in 15 days; these are 77-150 μ in diameter, forming from a mass of cells which enlarges by division in all planes. The pycnidia on the host under water are approximately the same size. At first the pycnidial primordia are light brown, but later turn black. Pycnidia occur singly or rarely fused in groups, are either round, pyriform, or irregular in shape, and have definite ostioles, sometimes in necks up to 40 μ long. The external pycnidial wall consists of black, thick-walled cells, and encloses several layers of more or less hyaline cells which give rise to spores progressively from the center, disintegrating as the spores are formed. Pycnidia are produced freely in aerial hyphae that emerge from cut ends of vascular elements when small cross sectional slices are placed on water agar or held submerged in sterile water blanks, but have not been found embedded in host tissue. Neither have they been found under field conditions. The spores are one-celled, hyaline, oblong, very small (1-1.5 x 2.5-4.0 μ), borne in enormous numbers, and emerge as milky droplets from the pycnidia. They are formed endogenously either directly through a pore from rounded pseudoparenchymatous cells, or from definite flask-shaped phialides; the latter type becomes common as the pycnidium ages. The conidia germinate readily on water agar in 24 hours.

This organism is strongly antagonistic to other fungi and is, therefore, presumed to produce toxins that might be injurious to the host.

Related fungi are known to invade vascular elements and induce disease. The mal secco disease of citrus in the Mediterranean area, caused by Deuterophoma tracheiphila (8, 9, 11, 12, 13), was the first disease of this type reported. The so-called Cephalosporium disease of elm in this country is caused by a fungus now designated as D. ulmi (6, 10, 16). There are striking similarities between these fungi and the type 1 chrysanthemum fungus. The development and morphology of the pycnidium (6, text fig. 2), and the appearance of the elm fungus in culture (6, pl. 13, figs. 6, 7) are very close to our type 1 fungus. In terms of relative injury to the host it should be noted that the citrus and elm fungi are parasitic for relatively long periods in an individual plant, whereas commercial chrysanthemums are replanted each year. This may account, in part, for the relatively mild symptoms produced in that plant.

Type 2 - This fungus apparently occurs predominantly in the cortical tissues and is restricted to the roots and basal parts of the stems. It does not exhibit antagonism to other fungi in culture.

It is relatively fast-growing in culture media, developing nearly twice as fast as type 1. The colonies are gray and fluffy, and bear numerous pycnidia readily visible to the naked eye. The pycnidia are at first light brown, beginning to darken at the ostiole, later becoming nearly black. They are round or hemispherical, 150-300 μ in diameter and com-

monly are formed partly embedded in tissue, rather than aerially. The spores are hyaline, 2.0-3.0 x 3.0-6.0 μ.

The fungus has developed pycnidia in the cortex of roots held in a moist chamber and in the cortex of basal stem tissue. It has not been obtained from points high in the stems, as has type 1. Neither has it been isolated from stunted chrysanthemum plants except in association with type 1. However, it has been found alone in nonstunt plants. All evidence suggests that this fungus is a cortical parasite of roots and crown, without incrimination in stunt disease in California.

Possible Method of Spread

Neither type of fungus has yet been observed to sporulate under field conditions. The fact that type 1 readily does so on stem tissue placed on water agar or held submerged in water, and that type 2 does so in stems placed on agar or held in a moist chamber, suggests that this also occurs naturally. Since both types invade the cortex, it is possible under field conditions that basal cankers may be formed in which pycnidia develop. Spores could then be splashed to the basal shoots from which cuttings are taken in commercial practice. If such cuttings were treated in a solution of rooting hormones, the spores would then be spread from the leaf and stem surface to the cut ends of many of the healthy cuttings. Likewise, the fact that the type 1 fungus will sporulate copiously when held under water suggests that bits of infected tissue which become submerged in the hormone tank might provide a source of inoculum. Similar spread is known for Phoma lingam (Tode) Desm. on cabbage seedlings (5).

That the fungus may develop slowly in the host is indicated by the small amount of mycelium sometimes found in healthy-appearing plants in lots having some stunted specimens. The relative amount of inoculum would then determine the rapidity and severity of appearance of the disease. Thus, planting uninfected cuttings in heavily infested soil might give rise to a sudden and severe outbreak of the disease.

Because of the general occurrence of the fungus in infected plants, transmission of it in cuttings, root divisions, and root suckers would be assured. It is also a possibility that the cuttings could be infected by spores formed in the vessels at the base of the plant and carried upward by the sap stream. In such a case there might be little or no mycelial development at the time of removal from the parent plant. Such vascular sporulation and spread has been reported for Deuterophoma tracheiphila in citrus (11), and D. ulmi, Ceratostomella ulmi Buisman, and Verticillium dahliae Kleb. in elm (4).

The type 1 organism has been found to survive for at least two months in dried chrysanthemum stems. It is, therefore, expected that the fungus would survive in compost piles, trash, and perhaps on equipment, boxes,

etc. for a long enough period to bridge the interval between chrysanthemum crops, and to permit dissemination in material other than living plants.

Heat Treatment of Infected Plants

To determine whether the type 1 Deuterophoma could be eradicated from the host, hot-water treatments were attempted. Plants known to be infected were treated at 120° and 125° F. for 30 minutes. Pieces of stem removed before and after treatment yielded the living fungus when cultured. The plants were potted and kept in the greenhouse. Nine out of 15 plants treated at 120° F., and none at 125° F. survived. Treatment of dried infected stems at 125° F. for 30 minutes likewise failed to eradicate the fungus. It is thought that heat therapy will prove ineffective against this disease.

Summary

A Deuterophoma sp. occurs in the vascular system of chrysanthemum plants in California that exhibit symptoms closely resembling the stunt disease. There is abundant mycelium in the phloem and xylem of such plants.

Isolated plantings into which no new stock had been introduced in recent years were free both of stunted plants and the fungus.

The same fungus occurred in typical stunt plants from a commercial greenhouse planting in Chicago, Illinois.

Inoculation tests are in progress to determine whether the disease produced by this fungus is the same as stunt of eastern chrysanthemums. The established facts about that stunt disease apparently are consistent with the idea of such a vascular Deuterophoma causing the trouble.

Heat treatments that killed chrysanthemum plants failed to eradicate the fungus from the host tissue.

A second Deuterophoma species occurred in the cortex of roots and crowns of stunted and normal chrysanthemum plants from California, Illinois, and Ohio. Its status as a parasite is uncertain.

Literature Cited.

1. Anonymous. Chrysanthemum stunt. Flor. Rev. 103 (2657): 45. 1948.
2. Ball, G. C. Status of mum stunt. Grower Talks (Geo. G. Ball, West Chicago, Illinois.) 12 (8): 19-22. 1948.
3. Ball, George J. The mum stunt situation. Grower Talks 12 (7): 6. 1948.

4. Banfield, W. M. Distribution by the sap stream of spores of three fungi that induce vascular wilt diseases of elm. Jour. Agr. Res. (U. S.) 62: 637-681. 1941.
5. Chupp, C. Manual of vegetable-garden diseases. p. 130. Macmillan Co., New York. 1925.
6. Creager, D. B. The Cephalosporium disease of elms. Arnold Arboretum Contr. 10. 1937.
7. Dimock, A. W. Chrysanthemum stunt. N. Y. State Flower Growers Bull. 26: 2. 1947. (Also in Flor. Rev. 101 (2607): 37. 1947.)
8. Fawcett, H. S. Citrus diseases and their control. 2nd ed. pp. 308-314. McGrow-Hill Book Co., New York. 1936.
9. Goidanich, G., and G. Ruggieri. Recenti osservazioni sulla biologia della 'Deuterophoma tracheiphila' Petri e considerazioni sull' eziologia del 'mal secco' degli agrumi. Accad. Naz. Lincei Rend. Classe Sci. Fis., Mat. e Nat. ser. 8, 3: 395-402. 1947.
10. _____, and _____. Un reperto di sistematica micologica di eccezionale interesse fitopatologico. Ric. Sci. Ricostruz. 17 (7-8), 7 pp. 1947.
11. _____, G. Ruggieri, and A. Gagnotto. Presenza di una terza forma di moltiplicazione agamica in Deuterophoma tracheiphila Petri. Ann. Speriment. Agr. 2, n.s. 5 pp. 1948.
12. Petri, L. Sulla posizione sistematica del fungo parassita delle piante di limone affette da 'mal del secco'. Boll. R. Staz. Pat. Veg. 9 n.s.: 393-396. 1929. (Abst. in Rev. Appl. Mycol. 9: 522. 1930.)
13. _____. Ulteriori ricerche sulla morfologia, biologia e parassitismo della 'Deuterophoma tracheiphila'. Boll. R. Staz. Pat. Veg. 10 n.s.: 191-221. 1930. (Abst. in Rev. Appl. Mycol. 10: 182-184. 1931.)
14. Post, K. Marginal lighting for identifying chrysanthemum stunt. N. Y. State Flower Growers Bull. 31: 3-5. 1948.
15. _____. Chrysanthemum stunt and stock selection. N. Y. State Flower Growers Bull. 39: 7-8. 1948
16. Verrall, A. F., and C. May. A new species of Dothiorella causing die-back of elm. Mycologia 29: 321-324. 1937.

DIVISION OF PLANT PATHOLOGY AND LOS ANGELES COUNTY AGRICULTURAL EXTENSION SERVICE, UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIFORNIA

OCCURRENCE OF FUSARIUM WILT IN A MARKET-GARDEN CROP OF RADISHES

William C. Snyder and Roy Bardin

During the month of July, Fusarium wilt of radish was observed in a market-garden planting of Early Scarlet radish made on peat soil in the Castroville District of Monterey County, California. This is the first time the disease has been seen in a crop grown for the roots and apparently is the second time this vascular wilt of radish has been recognized. The previous occurrence of the disease was[1] in a field of large seed plants of the White Chinese Winter radish which were being grown in San Benito County during April, 1934. The two counties are adjacent, and are subject to a coastal climate.

The market gardener reports having observed the disease in his field last year, for the first time, and estimates that the infested area now represents about one acre. A part of this season's planting was a total loss while in the remainder of it only 20 to 30 percent of the roots were harvestable.

Although many of the roots reached marketable size, and externally still appeared healthy at the time symptoms of yellowing and wilting occurred in the leaves, such roots upon cutting showed dark brown to almost black vascular discoloration. Other plants had failed to develop any storage root and were deeply discolored internally, while many plants in the same row had already died.

Fusarium oxysporum f. raphani Kendr. & Snyd., was readily isolated from discolored vascular tissue. Artificial inoculations made in the greenhouse by pouring a spore suspension from single spore isolates over sterilized soil, then planting to Early Scarlet radish gave typical wilt symptoms in about three weeks.

DIVISION OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA, AND MONTEREY COUNTY AGRICULTURAL COMMISSIONER'S OFFICE, SALINAS, CALIFORNIA

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1 Kendrick, James B. and William C. Snyder. Fusarium wilt of radish. Phytopath. 32: 1031-1033. 1942

TWO UNUSUAL RECORDS OF VEGETABLE DISEASES IN OREGON

Frank P. McWhorter

Squash Fusarium Root Rot Found in Oregon. A field of "Crook-Neck" yellow squash being grown for seed near Eugene, Oregon, developed typical symptoms of Fusarium foot-rot due to Fusarium solani f. cucurbitae Snyder and Hansen. Signs of the fungus are very abundant on and about the soft rooted stems of the plants. Invasion of the lower stem is followed by a sudden collapse and wilting of the plants. The disease has been evident for about a month and will probably kill about half the plants in the field before the season is over.

Macrosporium Leaf Blight of Cucumber in Oregon. According to information from growers a mild attack of Macrosporium cucumerinum [Alternaria cucumerina] appeared on cucumber foliage near Scappoose, Oregon in 1946. During 1947 we diagnosed the disease there on cucumbers being grown for the pickle factories. It attacked plants that were about half grown and continued as a mild leaf spot during the rest of the season. There was some field evidence that the disease was carried from field to field by strong winds.

During 1948 the disease has developed again as a mild leaf spot near Scappoose but there is now a severe outbreak on the Marketer variety near Eugene, Oregon. The fungus present in all these cases has been a typical Macrosporium with no Alternaria tendencies. Specimens and photographs of the leaf blight and fungus are being submitted to Plant Disease Survey under the Oregon number 1948-22.

OREGON STATE COLLEGE, CORVALLIS

VARIETAL RESISTANCE TO POTATO LATE BLIGHT IN WESTERN WASHINGTON IN 1948

Avery E. Rich

Climatic conditions were very favorable for the development and spread of potato late blight (Phytophthora infestans (Mont.) DBy.) in western Washington during the 1948 growing season. Some growers who did not carry out an effective spray or dust program suffered almost 100 percent loss.

The potato variety trial plots, which were located at the Northwestern Washington Experiment Station, Mt. Vernon, received two combination insecticide-fungicide dustings early in the season. No further blight control program was carried out so that observations could be made regarding varietal reaction to this disease.

On August 30, the amount of foliage killed by blight was estimated for each variety, based on an average of 25 hills. The results were as follows:

Variety	Foliage killed (percent)	Variety	Foliage killed (percent)	Variety	Foliage killed (percent)
Ashworth	T*	Katahdin	50	Red Warba	50
Cal Rose	T	Kennebec	5	Russet Burbank	50
Cayuga	10	Menominee	10	Snowdrift	5
Chenango	5	Mesaba	75	Warba	60
Cortland	5	Norkota	25	White Rose	60
Essex	T	Ontario	10	X1276-185**	95
Glenmeer	T	Placid	5	C.S.6316***	20
Harford	5				

* - Trace
** - Seedling from Maine Agricultural Experiment Station
*** - Seedling from Colorado Agricultural Experiment Station

It is interesting to note the great differences in resistance of various varieties to the late blight organism, and the progress that is being made by those who are breeding for blight resistance.

It is worthy of note that in an adjacent block which received no fungicidal treatment, Mohawk, which is not usually considered resistant, suffered only 15 percent defoliation in contrast to 95 percent on Russet Burbank.

It is possible that the variations in varietal resistance obtained at the above location from those obtained in other parts of the country might be due partially to the presence of different strains of the pathogen.

STATE COLLEGE OF WASHINGTON, PULLMAN

EXPERIMENTAL APPLICATIONS OF DUSTS AND SPRAYS TO BEANS FOR CONTROL OF SCLEROTINIA SCLEROTIORUM[1]

Edward K. Vaughan[2] and B. F. Dana[3]

In the Pacific Northwest white mold, Sclerotinia sclerotiorum, has been recognized over a period of more than a quarter of a century as a disease of minor importance on a wide variety of hosts including some vegetables. More recently intensive culture under irrigation of vegetables for processing has favored the increase of this disease in such a crop as the Blue Lake type of pole beans. Because of the actual and potential importance of this disease on beans a joint program of investigations was initiated in 1947 by the Oregon Experiment Station and the U. S. Department of Agriculture. The following is a presentation of data obtained in 1948 from the application of dusts and sprays for the control of white mold on Blue Lake beans.

Various workers (1, 3, 4) have reported that application of sprays and dusts gave little or no protection against infection by Sclerotinia sclerotiorum. Brooks (1) and others (2, 4) have reported a limited degree of control as a result of application to the soil of 500 to 1,000 lbs. of Cyanamid per acre, and Townsend and Ruehle (4) have reported that flooding the soil for four to five weeks in late spring or summer controlled the disease in Florida celery fields. Because of the limited effectiveness of chemical control and the impracticability of long-time flooding in most areas, crop rotation has remained the standard measure for control of this disease.

Although attempts to control white mold by the use of sprays or dusts had not been very successful in other sections, a comparison of environmental factors in the Pacific Northwest with factors in these other areas has encouraged the writers to set up control tests with both sprays and dusts. During the season of 1948 two experiments were carried out with the variety Regular Blue Lake. In both localities the replicated and randomized plots were irrigated by overhead sprinklers at intervals of approximately one week and the sprays and dusts were applied the day following irrigation.

At Corvallis six materials were applied as sprays, by means of a wheelbarrow type of power sprayer, and three as dusts, with a hand duster. The

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[1] Published as Technical Paper No. 559 with the approval of the Director of the Oregon Agricultural Experiment Station, contribution of the Department of Plant Pathology.

[2] Plant Pathologist, Oregon Agricultural Experiment Station.

[3] Plant Pathologist, U. S. Department of Agriculture.

results are shown in Table 1.

Table 1. Control of Sclerotinia sclerotiorum infection in Blue Lake Beans by Sprays and Dusts, Corvallis, Oregon.

Material Used	Mean Numbers of Centers of Infection per 30-ft. row[a]			Mean number of plants killed by fungus per 30-ft. row
	Aerial Infections	Basal Infections	Total Centers of Infection	
Sprays				
Parzate	23.25	29.00	52.25	22.75
Phygon	27.25	37.00	64.25	35.25
Bioquin	12.75	15.00	27.75	11.25
Bismuth subsalicylate	2.25	1.50	3.75	3.50
Zerlate	9.75	10.75	20.50	7.75
Silver Nitrate	25.00	27.50	52.50	27.25
Dusts				
Copper-sulphur	10.75	10.25	21.00	13.75
Phygon	14.50	24.00	38.50	23.50
Parzate	25.50	35.50	61.00	29.00
Untreated Check	20.25	21.00	41.25	24.50
Required for Significance at 5% level	12.63	14.35	25.52	13.28

[a] 4 replicates

Failure of sprays and dusts to control infection by Sclerotinia sclerotiorum has been explained on the ground that most infections resulted not from germinating ascospores but from mycelium growing saprophytically in soil which, after infecting the plants, grew upward through the stems and hence could not be reached by fungicides on the surface of the plants.

In recording the data from these experiments two types of infections were distinguished. Infections where some part of the infected area was or could have been in contact with the soil were designated as basal. Those where no part of the infected area was or could have been in contact with the soil and where infection could only have resulted from air-borne inoculum were called aerial infections.

The data in Table 1 are of interest because of the degree of control of aerial infections resulting from application of certain of the fungicides.

One material, bismuth subsalicylate, reduced the number of infections very markedly. Some materials gave lesser degrees of control, while others appeared to have injured the plants sufficiently to have opened up additional infection courts.

The data indicate also that the control of basal infections was roughly parallel to the control of aerial infections. This fact is of particular interest since it indicates either (a) that most of the infections occurring low on the plant are caused by germinating ascospores, or (b) that they are caused by mycelium growing superficially on the outside of the stems and hence subject to the action of the fungicides. The very small number of basal infections in the plots sprayed with bismuth subsalicylate also indicates that the number of cases of direct infection by mycelium from the soil through the roots and stem was not great. The writers have observed many instances where above-ground infections killed the stems down to about 1 1/2 inches from the soil surface but left the base of the plant apparently healthy. Comparatively few instances have been observed in these plots where the entire plant was killed by Sclerotinia sclerotiorum until late in the season.

Since some centers of infection involve only individual pods or leaves and have negligible effect upon the amount of crop produced, records were also made of the number of plants in each plot that had been girdled at or near their bases, and therefore would not produce a normal crop of beans. These data are roughly parallel to those for total centers of infection and tend to indicate that the data for total infections are a reasonably accurate measure of the losses sustained as a result of Sclerotinia infection and of the degree of control attained as a result of the application of fungicides.

At Eugene, Oregon, four fungicides were tested as dusts, applied by means of hand dusters. The data from these tests are presented in Table 2. Infections in this plot were less severe than in the plot at Corvallis. This was due to greater exposure to drying winds, to smaller size of the plot, and to the fact that no artificial inoculations of any kind had been made, whereas in the plot at Corvallis sclerotia with active apothecia were placed in each individual plot when the plants were approximately 24 inches high. Infections were not uniformly distributed in the plots and as a result the data obtained are not statistically significant. It is entirely possible that the discrepancy between the degrees of control obtained with Phygon dust at Corvallis and at Eugene is more the result of infection escape than of control by the fungicide.

It must be emphasized that while the data from the trials at Corvallis and Eugene are of interest they are from tests carried on for one season only and in a single geographic area. No conclusions have been drawn from them but they will be used as a basic for further investigations.

Table 2. Control of Sclerotinia sclerotiorum Infection in Blue Lake Beans by Dusts. Eugene, Oregon.

Material Used	Mean Number of Centers of Infection per 30-ft row[a]: Aerial Infections	Basal Infections	Total Centers of infection
Kolodust	1.00	1.00	2.00
Parzate Dust	14.33	13.67	28.00
Phygon Dust	3.67	4.00	7.67
Bioquin Dust	3.33	7.67	11.00
Check	20.00	13.67	33.67

[a] 3 replicates

Literature Cited.

1. Brooks, A. N. Control of sclerotiniose of celery in Florida muck. Phytopath. 30: 703. 1940. Abst.
2. _____, W. D. Moore, and H. I. Borders. Sclerotiniose of vegetables and tentative suggestions for its control. Florida Agr. Exp. Sta. Press Bul. 613. 1945.
3. Moore, W. D., and W. J. Zaumeyer. Saving beans from watery soft rot. U. S. Dept. of Agriculture. A.I.S. 70. May 1948.
4. Townsend, G. R., and Geo. D. Ruehle. Diseases of beans in southern Florida. Florida Agr. Exp. Sta. Bul. 439: 4-56. 1947.

DEPARTMENT OF PLANT PATHOLOGY, OREGON AGRICULTURAL EXPERIMENT STATION, AND DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, U. S. BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, CORVALLIS, OREGON

EFFECT OF INSECTICIDAL SPRAYS ON INCIDENCE OF PEACH SCAB IN WEST VIRGINIA

Edwin Gould and Carlton F. Taylor

Sulfur applications starting one month after bloom are recommended to control peach scab (Cladosporium carpophilum). To ensure coverage within this period, the first sulfur application for scab control is recommended at the first cover period. In the experiment reported here the first sulfur application was delayed from May 10 (first cover) until May 24 (second cover) and little or no scab control was obtained. However, it is interesting to note that early season application of a spray mixture of acid lead arsenate, zinc sulfate and hydrated lime gave good control of peach scab in 1948[1].

Table 1. Effect of insecticides on the incidence of peach scab

Material and concentration, pounds per 100 gallons	Percent scabbed, based on total crop from 10 trees per plot: Replicate A	Replicate B	Weighted average*
1. Acid lead arsenate, 2	0.1	5.5	2.6
Flake zinc sulfate, 6			
Hydrated lime, 8			
2. Benzene hexachloride (10% gamma isomer) 2	27.4	70.3	47.2
3. Chlordan, 40%, 2 1/2	19.3	79.3	53.4
4. Toxaphene, 40%, 4	--No fruit due to spray injury--		
5. Parathion, 25%, 1/2	37.2	18.5	31.8
6. Parathion, 25%, 1	42.4	87.5	65.4
7. Benzene hexachloride, 2			
DDT, 2	37.1	70.7	56.6
8. Benzene hexachloride, 2			
Parathion, 1/2	32.0	81.9	62.1
9. Acid lead arsenate, 2			
Flake zinc sulfate, 6	0.5	7.3	5.4
Hydrated lime, 8			
Parathion, 1/2			
10. Acid lead arsenate, 2			
Flake zinc sulfate, 6			
Hydrated lime, 8	0.5	3.5	2.8
DDT, 2			

* The number of record peaches varied from 1288 to 2295 per treatment.

1 These data were obtained by the senior author in a test of the effectiveness of various organic insecticides against peach insects. The test orchard was located in Berkeley County, West Virginia near the University Experiment Farm, Kearneysville, West Virginia.

This information was obtained in an experiment consisting of two replicated 50-tree plots of each of ten treatment schedules on vigorous five-year-old Elberta trees. The data presented in Table 1 are the averages of all fruits from 10 trees in the center of each 5 x 10 tree plot. Spray applications were made at 600 pounds pressure, using an 8-nozzle broom gun equipped with #4 (4/64 inch) nozzle orifices. The spray dates were April 20 (petal-fall), April 26, May 10, and May 24. The material schedules shown in Table 1 were continued through the first three applications. The fourth application differed only in that 8 pounds per 100 gallons of flotation sulfur was added to each series.

Toxaphene was the only material showing noticeable injury to the fruit or foliage. Here more than half of the foliage and all of the fruit dropped within ten days following the third application. This treatment was discontinued at that time and the trees made rapid recovery.

Sulfur was not applied until May 24, 39 days after the 1943 average petal-fall date of April 15. This was somewhat later than the "one month after petal-fall" usually recommended in this section for scab control. That this delay in the sulfur application permitted scab infection is shown by the high percentage of infected fruits from certain plots.

The data presented in Table 1 show a striking and consistent reduction in the percentage of peaches infected by scab wherever lead arsenate/zinc sulfate was used. Furthermore, infection on the lead/zinc series consisted of very few spots per peach while on the organic insecticide plots, many fruits were so severely scabbed that fruit cracking resulted.

These data show that the lead arsenate/zinc sulfate mixture commonly used on peaches gave a considerable degree of protection against peach scab. On the other hand, the organic insecticides gave little if any protection. Where such materials are used, close attention should be given to the correct timing of sulfur applications for the control of scab.

WEST VIRGINIA UNIVERSITY, MORGANTOWN

GLOMERELLA CINGULATA ON PEACHES FROM GEORGIA AND MARYLAND

John C. Dunegan and Joyce Kephart

At the Chicago 1947 meetings of the American Phytopathological Society, Ramsey, Smith, and Heiberg[1] reported the arrival, in northern markets during the month of July 1947, of peaches infected by the bitter-rot fungus, Glomerella cingulata. Subsequent discussion with Smith revealed the fact that the diseased fruit originated from orchards in the Marshallville, Georgia, area.

On July 30, 1948, John H. Weinberger, of the U. S. Horticultural Laboratory at Fort Valley, Georgia, submitted four Elberta peaches showing typical bitter-rot symptoms, i.e., circular lesions with concentric rings of spores. Weinberger stated that approximately 25 percent of fruit in one of his experimental blocks was affected with this disease. Pure cultures were obtained from this Fort Valley material and within ten days the organism began producing perithecia of the bitter-rot fungus. The original cultures and subsequent transfers from them have continued to produce perithecia predominantly, with conidial spore masses appearing only sparingly as the cultures age.

Early in September 1948, L. P. McColloch, of the Division of Fruit and Vegetable Crops and Diseases, submitted Georgia Belle peaches from his garden at Kensington, Maryland. These peaches showed circular lesions with masses of Gloeosporium spores in concentric rings. The spots on the Georgia Belle peaches from Maryland did not differ in appearance from those received from Georgia. Pure cultures were obtained readily from the Maryland material but instead of producing perithecia these cultures have produced masses of conidia.

Apples and peaches were inoculated with spores from the Georgia and Maryland cultures. Aside from the lack of conidia on the fruit inoculated with the Georgia material, the other symptoms which developed were typical of the apple bitter-rot disease.

DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE

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[1] Ramsey, G. B., M. A. Smith, and B. C. Heiberg. Anthracnose of peaches on the market. Phytopath. 38: 22. 1948

PRUNUS UMBELLATA - A HITHERTO UNREPORTED HOST OF TRANZSCHELIA PRUNI-SPINOSAE VAR. TYPICA

John C. Dunegan

On November 2, 1948, the writer in company with W. F. Turner, of the Bureau of Entomology and Plant Quarantine, and John H. Weinberger and G. E. KenKnight of the Bureau of Plant Industry, Soils, and Agricultural Engineering, noted rust sori (both uredia and telia) on leaves of Prunus umbellata in a plum thicket near Marshallville, Georgia.

Microscopic examination of the specimens showed teliospores of the form commonly found on other species of plum and wild cherry in the area. The specimens from P. umbellata accordingly were referred to the typica variety of Tranzschelia pruni-spinosae. A subsequent examination of host records, maintained by the writer, revealed that the rust had not been reported previously on this host.

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NUT DISEASES IN THE PACIFIC NORTHWEST IN 1948

P. W. Miller

Walnut Diseases

Walnut blight (Xanthomonas juglandis (Pierce) Dowson). Walnut blight was widely distributed in the Pacific Northwest in 1948, causing greater loss than normal. In certain non-sprayed Persian (English) walnut orchards in western Oregon, losses from this disease ranged up to 50 percent of the potential crop. However, for the region as a whole it is estimated that approximately 25 percent of the potential crop in non-sprayed orchards was either completely destroyed or had the quality adversely affected by this disease.

Mushroom root rot (Armillaria mellea Fr.). This disease caused the death of a limited number of mostly seedling Persian walnut trees in Oregon in 1948.

Downy spot (Microstroma juglandis (Bereng.) Sacc.). This leaf spot occurred in slight amounts in a few orchards in western Oregon in 1948. It was of no economic importance, however, since it did not cause any defoliation or decrease the functional leaf area significantly.

Walnut shrivel (non-parasitic). This disorder, characterized by a partial to a complete shriveling of the kernel, was more prevalent and severe in the Pacific Northwest in 1948 than it has been for many years. In certain orchards up to 75 percent of the crop was affected. For the region as a whole, however, it is estimated that approximately 25 percent of the 1948 walnut crop was affected to a greater or less extent with this disorder. It is believed that the occurrence of two weeks of abnormally hot, drying weather at the critical time of filling of the nuts, with accompanying moisture and associated nutritional deficiencies, is largely responsible for this disorder.

Leaf scorch (non-parasitic). This leaf disorder was widely distributed in the Pacific Northwest in 1948, occurring to a greater or less extent in most Persian walnut orchards in this region. In orchards on certain soil types deficient in boron it was very prevalent, causing a significant decrease in the functional leaf area through death of the tissues and premature defoliation. Application of borax in sufficient quantities to the soil generally decreased the amount and severity of this disorder.

Black-line (girdle) of grafted walnuts (non-parasitic). This disorder caused the death of more grafted Franquette walnut trees in 1948 in the Pacific Northwest than any other agency. It was widely distrib-

uted, occurring to a greater or less extent in practically all walnut districts in the Pacific Northwest. All the trees found affected belonged to the Franquette variety grafted on California black walnut rootstocks (Juglans hindsii Sarg.) or hybrids of other species with this one.

Root-rot (cause undetermined). A root-rot of undetermined cause was found affecting a number of Persian walnut trees grafted on California black walnut and hybrid black walnut rootstocks in western Oregon. Most of the affected trees were located in hill orchards on either shallow or "heavy," wet soils.

Filbert Diseases

Bacterial blight (Xanthomonas corylina (Miller et al.) Dowson). This disease was widely distributed in 1948, occurring to a greater or less extent in practically all filbert orchards in western Oregon. It was most prevalent in young orchards, from 1 to 3 years of age, causing the death of many young trees. It also occurred in many older orchards where it caused the death of buds and twigs.

Mildew (Phyllactinia corylea (Pers.) Karst.). This disease occurred in varying amounts in many orchards in western Oregon in 1948. However, it was of no economic importance since the disease did not make its appearance until very late in the season. The infected leaves retained their normal green color until the end of the season and persisted on the trees until the time of normal leaf fall.

Leaf scald (non-parasitic). This disorder was widely distributed in the Pacific Northwest in 1948. The trouble was much worse in orchards located on relatively shallow soils with low reserves of soil moisture.

Brown stain (non-parasitic). This disorder of the nuts occurred in limited amounts in a number of orchards in the Pacific Northwest in 1948.

Filbert shrivel (non-parasitic). This disorder, characterized by a shriveling of the kernels, was widely distributed in the Pacific Northwest in 1948, occurring to some extent in practically every orchard in Oregon and Washington.

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PARASITIC DISEASES OF TUNG

John R. Large[1]

The tung industry in the United States is so new that parasitic diseases have not become extensively established. It is to be expected that with the increase in number of tung orchards, diseases will become more prevalent. For one thing, disease organisms that now attack other crops may attack tung. For example, the thread blight, which was first observed on tung in 1927 and is now becoming one of its most serious diseases in the southern United States, has been known for many years on other woody plants. Web-blight, a disease first observed on tung seedlings in the nursery in 1943, was reported on beans in Florida in 1939. A fungus of the black rot type, Diplodia natalensis, has been known to produce trunk cankers and fruit rots of citrus for many years and what apparently is the same organism was found on tung by the writer in 1945.

At present some 17 diseases of tung caused by bacteria and fungi have been reported, and 6 new diseases believed to be due to fungi are under study. Of the 17 known diseases, 11 have been observed in the United States and 6 in Nyasaland, India, or China. Tung trees may also be parasitized by nematodes. As yet none of these diseases is of great economic importance; nevertheless it is wise to know the symptoms, and to be prepared with control measures. In this paper 8 fungus and bacterial diseases most common in tung orchards of the southern United States and the effects of nematodes will be discussed in some detail.

BACTERIAL LEAF SPOT, Bacterium aleuritidis.

Boyd (1) reported a prominent spotting of leaves of tung trees in southern Georgia. McCulloch and Demaree (14) isolated the organism from these lesions, infected healthy plants by inoculating with the pure cultures, and named the organism Bacterium aleuritidis.

Infections are first evident as small, greenish, translucent spots which soon become brown, opaque, and angular. The active advance of the infection is marked by a wide, indefinitely margined, yellowish halo. The progress of the infection is usually checked by the larger veins, with the formation of isolated angular lesions, 1 to 20 mm. wide, which are dark brown to black on the upper surface and somewhat lighter in color on the lower surface. A definite narrow border darker than the center is usually noted. The infected tissues are dull, dry, and opaque,

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[1] U. S. Field Laboratory for Tung Investigations, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Bogalusa, Louisiana.

often shriveling and cracking; there is no exudate. Lesions occur on all parts of the leaf blade; they are usually well distributed but are most numerous where moisture is most abundant. No control methods have been tried because only a few isolated trees are infected. The disease is not widely distributed, nor does it attain epiphytotic proportions. According to Boyd (1) infection occurs on trees of all ages, but is most likely to be destructive to those 1 or 2 years old. It has been reported from several nurseries in Georgia, from one area of mature trees near Florala, Alabama, and from three different orchards of 3-year-old trees in Louisiana. One tree in Louisiana was partially defoliated.

ALCOHOLIC FLUX (causal organism not definitely determined).

Alcoholic flux, white slime flux, or wetwood, is a rather spectacular disease of tung trees, which has infected 25 or 30 isolated trees in 5 orchards in Louisiana, Mississippi, and Alabama. This disease becomes evident in late summer, usually during the early part of September, when a foamy exudate is seen bubbling from cracks in the bark near the crotch of the tree. This is accompanied by the characterisitc odor of fermentation, which attracts beetles, hornets, and other insects. Later in the season an icicle-like mass of gelatinous material or slime flux extends down the trunk of the tree from the crotch. The canker may extend laterally until the trunk is girdled; and the tree is eventually killed. This disease has been described on oaks, elms, and other shade trees. Carter (2), studying wetwood of elms, isolated a bacterium, which he named Erwinia nimipressuralis, from the heartwood and older sapwood of the trunk and large branches. The bacterium ferments carbohydrates and other materials in the infected wood and produces gas as a by-product, creating high pressures which force the sap out of the infected wood and cause it to escape through cracks in the bark near the crotch. This exudation of sap is called flux. Hines (7) controlled the disease in several tung trees in a Louisiana orchard by excising infected tissues and painting the wounds with bordeaux paste.

A bacterium has repeatedly been isolated from tung trees affected with alcoholic flux, but attempts to produce the disease by inoculating healthy trees with pure cultures have failed.

THREAD BLIGHT, Corticium stevensii (Pellicularia koleroga).

The thread blight fungus overwinters as chestnut-brown, bead-like sclerotia on the twigs. In early May thread-like mycelia grow from the sclerotia and extend over the twigs and petioles, and finally over the leaves in a solid mat. The leaves are killed but when dead they hang to the twigs, suspended by the fungus threads. Before the leaves die spores may be formed on the surface of the fungus mat, which presumably are capable of spreading the disease, at least under certain conditions. However, to date no definite instances are known in which new infections were

caused by these spores. In 1941 the disease was introduced into an isolated, abandoned orchard near Varnado, Louisiana, by placing infected leaves and twigs in contact with the foliage of one tree. The disease is still confined to the one tree originally infected, whereas if spores were carried by the wind and produced infection freely, one would expect every tree in the orchard to be diseased by now. Apparently the disease is spread from tree to tree only by contact of the branches or by infected leaves being carried to healthy trees. Presumably birds and small four-footed animals may carry bits of mycelium from tree to tree.

Thread blight has been found on 20 native woody swamp plants (9). Most of the tung orchards in the United States in which the disease occurs are located on low ground, close to or surrounded by swamps. It is believed that the disease has spread from the native swamp plants to the adjacent tung orchards, and that relatively humid conditions are necessary for its development.

Thread blight has been observed in 10 orchards in the United States, 2 in Florida, 2 in Mississippi, 5 in Louisiana, and 1 in Texas. New centers of infection have been found annually, indicating that it may be expected to become progressively more prevalent in the future. Since this disease destroys part of the foliage, it must reduce the food supply to the infected limb, prevent the fruit from maturing properly, eventually weaken the branch and reduce its resistance to low temperature. Yet in one seriously infected orchard where no control measures are practiced, the trees continue to produce about 1 to 1 1/2 tons of fruit per acre per year. These trees are 15 to 16 years old, are on excellent soil, and are fertilized heavily. They would undoubtedly produce considerably more if healthy.

Experiments for the control of thread blight by pruning and by spraying have been conducted at Varnado, Louisiana, since 1941 and spraying tests have been conducted by John H. Painter at Lamont, Florida, since 1942. Control by pruning is not practical in orchards where the disease has gained a firm foothold; but if a single branch or a single tree is found infected in an orchard, it is advisable to remove and burn it. Thread blight may be controlled, but not eradicated, by spraying once a year with 6-6-100 bordeaux mixture (6 pounds of copper sulfate, 6 pounds of hydrated lime, and 100 gallons of water). The best time of application is between June 1 and June 15, but satisfactory results are obtained in most seasons at any time between May 20 and July 10.

WEB BLIGHT, Corticium microsclerotia (Pellicularia filamentosa).

A disease closely related to thread blight has been found on seedling tung trees in the nursery (10). This disease usually is found on leaves 6 to 18 inches above ground, and causes them to turn brown and die.

Young infection spots are light tan and 0.2 to 2.0 cm. in diameter. As the lesions grow larger, light tan hyphae develop on the shaded side of the leaf. These hyphae extend rapidly over the surface of the leaf blade, progressively killing it. Under conditions of high humidity the hyphae spread out and cover both the blade and the petiole. Often the hyphae grow to adjacent leaves, causing them to stick together. Old diseased leaves have a very ragged appearance. Often numerous grains of sand stick to the hyphae. During a rainy period the petiole and blade of an infected leaf may be covered with fine, close-growing, entangled hyphae that bear clumps of light brown sclerotia.

This disease was first observed in a tung nursery in Mississippi in 1942, and has been found in one tung nursery in Louisiana and one in Georgia. Weber (24) says that in Florida web blight is one of the most serious diseases of beans, causing hampers of apparently healthy string beans to mold while in transit to the northern markets.

Since this disease has been found only on leaves 6 to 18 inches above the ground, it is of minor importance in the tung nursery; but under favorable environmental conditions it is possible that a severe epiphytotic might develop, defoliating the trees and stunting their growth.

BLACK ROT CANKER, Physalospora rhodina.

A disease observed on tung for the first time in 1944 is a source of much concern to several tung growers in the western part of the tung belt. During late summer and early fall the disease, as observed on tung in four orchards in Mississippi and Louisiana, was characterized by black sunken cankers on the trunks, limbs, twigs, shoots, or leaf petioles. Sometimes the canker girdled the trunk, killing the tree back almost to the soil level, after which new shoots developed just below the canker. In other cases only a single branch, such as the tip of the central leader, was affected. When a canker girdled the trunk or branch, the leaves wilted suddenly and the affected part died. The following spring many of the dead branches developed ash-grey cankers with numerous black perithecia, which contained hyaline asci and ascospores, scattered over the surface. When the perithecia were cut transversely the contents had the snow white appearance characteristic of Physalospora rhodina.

Pycnidia containing single-celled hyaline spores were consistently observed on dead branches collected in the fall. Upon examination of this material a year later several dark bicellular spores were observed. This change from single-celled spores to bicellular spores is typical for the Diplodia stage of Physalospora rhodina. In culture the tung Diplodia grew rapidly at 37° C. Cultures growing on rice medium at 37° C. and at room temperature showed definite chromogenesis. Large (13) demonstrated pathogenicity by inoculation of tung seedlings, which developed both the Physalospora and Diplodia stages of the organism. This disease was eradi-

cated from one orchard in Pearl River County, Mississippi, by pruning out and burning all diseased branches. The procedure of roguing out and burning diseased trees is the most practical control for this disease.

NUT ROT, Botryosphaeria ribis.

This disease seems to become more widespread as time goes on. It begins by forming small brown lesions on the green tung fruit, which are first observed about the middle of July. As the season advances the lesion spreads over the fruit, burning the diseased tissue brown. Fruits infected early in the season tend to drop prematurely. If infected late in the fall the entire fruit mummifies and hangs on the tree. On close examination of the mummified fruit, minute black pycnidia are found scattered over the surface. These pycnidia, when cut transversely, appear white in cross section, which is a characteristic of Botryosphaeria and Physalospora. These organisms are found on many native swamp and field crops throughout the tung belt.

The disease causes a loss in oil content, ranging from 100 percent in fruits infected early in the season, to practically none in fruits infected in late September. No instances are known in which the average loss for the whole crop in a given orchard has exceeded about 5 percent of the total oil. The losses generally would not justify any expensive control measures and at present there is no known remedy other than good culture to keep the trees vigorous. Preliminary spray experiments seem to indicate that it may be controlled by spraying with bordeaux mixture and oil.

SEPTOBASIDIUM CANKER, Septobasidium pseudopedicellatum.

This is a superficial fungus which forms small to very extensive conspicuous felt-like, spongy to leathery crusts on the bark and leaves of a great variety of trees and shrubs. It has been observed on tung trees in two orchards in Louisiana. Some of the other trees attacked by this fungus are apple, Malus; ash, Fraxinus; oak, Quercus; pecan, Hicoria; sweetgum, Liquidambar; maple, Acer; magnolia, Magnolia; holly, Ilex; Citrus, and others, totaling 69 reported host plants.

The color of the fungus body varied from light buff to smoke grey and chocolate brown, occurring in patches along a branch. The fruiting surface (hymenium) grows around the branch, eventually girdling it, causing death above the fungus fruiting body. Four-celled basidia develop on the upper surface of the fruiting body. This fungus is a Hemibasidiomycete. Couch (3) says Septobasidium shows several characteristics that indicate an unmistakable morphological relationship to the rusts of cereal crops.

The fungus develops in bodily union (conjuctive symbiosis) with a variety of scale insects. The fungus forms a canopy over the scale in-

sects, protecting them from inclement weather and bird and insect enemies; some of the insects are parasitized and nourish the fungus, while others thrive, reproduce and disseminate the fungus.

Couch (4), describing the relationship between the insects and the fungus Septobasidium fraxini, says that minute tunnels lead from igloo-shaped entrance holes down to the house or chamber of the insect. Parasitized insects have a column of hyphae extending into the vaginal pore, and in insects that have been infected for some time the posterior part of the body is rather well filled with coiled haustoria.

Growth of the fungus with its colony of scale insects eventually girdles and kills the branch. Because of its very recent and limited occurrence on tung, it is impossible to predict its economic importance. Couch (3) reported that attempts at control by means of sprays have to date proved unsatisfactory. The recommended control method is to prune out infected branches.

CLITOCYBE ROOT ROT, Clitocybe tabescens.

Clitocybe root rot is another potentially serious disease that occurs on isolated trees throughout the tung belt. It occurs on native oak and other forest trees, and may be in the soil of newly cleared land. If a tung tree is planted in a place where a diseased oak was removed, the tung tree may become infected. This disease is characterized by sudden wilting of the leaves in midsummer, which is followed shortly by the death of the tree. On removing the bark of a dead tree at the ground level, one can often find a white or grey mat of fungal threads between the bark and the wood of the trunk. This is the vegetative growth of the fungus. Later in the summer one may find light brown toadstool-like fruiting bodies growing at the base of a tree that has been killed by the fungus.

There is no inexpensive method for its control. In citrus orchards in Florida Rhoads (21) has reported marked success with surgical treatment sometimes combined with exposure of the root crown to aeration and drying. Fumigation of the soil with carbon disulfide has been practiced and is believed to kill the fungus. These treatments are too expensive to be used commercially in tung orchards.

ROOT KNOT NEMATODE, Heterodera marioni.

Nematodes may cause weakening and stunting of tung trees during the first year of growth in the nursery, and infested trees may be more subject to winter injury than healthy trees. Dickey and Mowry (5) and Taylor and McBeth (22) observed that such trees will usually outgrow the infestation when planted in the orchard.

To prevent the nematode infestation, the tung nursery should be planted on new land or in soil that has been in grass pasture for at least two years. If the entire farm has been cropped it is wise to plant the tung nursery on land that has been planted to peanuts, velvet beans, crotalaria, oats, or rye, as these crops have a tendency to reduce the nematode population. A rotation of two or three of these resistant crops will reduce the nematode population to such an extent that the tung trees may not become seriously infested.

Diseases that have been observed on tung in the United States but appear to be of minor importance are: leaf spot, Gloeosporium aleuriticium (20); Southern blight, Sclerotium rolfsii (17); and Phytophthora root rot, Phytophthora cinnamomi (19). Six diseases have been reported outside the United States. Forbes (6) reported on the diseases of tung in Nyasaland and listed leaf spot, Glomerella cingulata; dieback, Colletotrichum gloeosporioides and Glomerella cingulata; collar crack, Armillaria mellea; and collar rot, Ustulina zonata. Narasimhan (15) observed a root rot of tung in India, caused by Phytophthora palmivora; and Ou (16) made a detailed study of Cercospora leaf spot of tung in China, caused by Mycosphaerella aleuritidis.

Summary

Nine of the most serious disorders of tung are discussed in some detail in this paper, namely, bacterial leaf spot, Bacterium aleuritidis; alcoholic flux (causal organism not definitely determined); thread blight, Corticium stevensii; web blight, Corticium microsclerotia; black rot canker, Physalospora rhodina; nut rot, Botryosphaeria ribis; Septobasidium canker, Septobasidium pseudopedicellatum; Clitocybe root rot, Clitocybe tabescens; and nematode root knot, Heterodera marioni.

Of these diseases thread blight and nut rot are at present most serious. Control of thread blight by spraying is feasible when and if losses justify the cost. As yet no control is known for nut rot other than good culture to keep the trees vigorous.

Three other diseases of minor importance in the United States are leaf spot, Gloeosporium aleuriticum; Southern blight, Sclerotium rolfsii; and Phytophthora root rot, Phytophthora cinnamomi.

In addition, six diseases of tung have been reported from foreign countries, as follows: from Nyasaland, leaf spot, Glomerella cingulata; dieback, Colletotrichum gloeosporioides and Glomerella cingulata; collar crack, Armillaria mellea; and collar rot, Ustulina zonata; from India, root rot, Phytophthora palmivora; and from China, Cercospora leaf spot, Mycosphaerella aleuritidis.

Literature Cited.

1. Boyd, C. C. A bacterial disease of the tung-oil tree. Phytopath. 29: 756-758. 1 fig. 1930.
2. Carter, J. C. Wetwood of elms. Illinois Nat. History Survey Bul. 23(4): 407-448. 1945.
3. Couch, J. N. The Genus Septobasidium. Univ. North Carolina Press. 1938.
4. _____. Two species of Septobasidium from Mexico with unusual insect houses. Jour. Elisha Mitchell Sci. Soc. 62(1): 87-94. 1946.
5. Dickey, R. D., and Harold Mowry. The effect of root-knot upon the subsequent growth of tung-oil, Aleurites fordii, seedlings. Proc. Amer. Soc. Hort. Sci. 36: 389-392. 1938.
6. Forbes, A. P. S. Some tung oil diseases in Nyasaland. Nyasaland Tea Assn. Quarterly Jour. 4(4): 4-10. 1940.
7. Hines, Lee. The disease situation in tung. Proc. Amer. Tung Oil Assoc. 6: 11-13. 1940.
8. Large, J. R. Root-knot of tung and its control. Proc. Amer. Tung Oil Assoc. 9: 34-47. 1943.
9. _____. Recent observations on thread blight, Corticium stevensii, of tung and some native plants in the southeastern United States. Plant Disease Reporter 27 (10/11): 223-224. 1943.
10. _____. Web blight of seedling tung trees tentatively identified as the Rhizoctonia stage of Corticium microsclerotia. Phytopath. 34(7): 648-649. 1944.
11. _____. Alcoholic flux or white slime flux of tung trees. Plant Disease Reporter 28 (1): 35-36. 1944.
12. _____. Tung Diseases - 1945. Proc. Amer. Tung Oil Assoc. 11: 31-37. 1945.
13. _____. Canker of tung trees caused by Physalospora rhodina. (Submitted to Phytopathology for publication).
14. McCulloch, Lucia, and J. B. Demaree. A bacterial disease of the tung oil tree. Jour. Agr. Res. 45(6): 339-346. 3 figs. 1932.
15. Narasimhan, M. J. Studies in phytopathology in India in 1932. Biochem. and Allied Research in India. 47-54. 1932.
16. Ou, Shih Kuang. A study of the cercospora leaf spot of the tung-oil tree. Sinensia 11(3/4): 175-188. 9 figs. 1940.
17. Plant Disease Survey Report. Diseases of ornamental and miscellaneous plants. Plant Disease Reporter 19(12): 214-215. 1935.
18. Plakidas, A. G. Diseases of tung trees in Louisiana. Louisiana Agr. Expt. Sta. Bul. 282: 1-11. 6 figs. 1937.
19. _____. Plant disease control. Louisiana State Fruit and Truck Station Biennial Report 1937-1938. 22-29.
20. Persons, T. D. New or unusual diseases reported or observed in Mississippi in recent years. Abstract. Annual Meeting Southern Division American Phytopath. Soc. Phytopath. 24: 843. 1934.

21. Rhoads, A. S. Clitocybe root rot of citrus trees in Florida. Phytopath. 38: 44-61. 1948.
22. Taylor, A. L., and C. W. McBeth. Root-knot resistant crops: root-knot and seedling tung trees: root-knot susceptible and resistant grasses. Georgia Coastal Plain Expt. Sta. Bul. 31: 113-123. 1940.
23. Weber, G. F. Thread blight. Fla. Agr. Expt. Sta. Bul. 186: 141-162. 9 figs. 1927.
24. _____. Web-blight, a disease of beans caused by Corticium microsclerotia. Phytopath. 29: 559-575. 7 figs. 1939.

U. S. FIELD LABORATORY FOR TUNG INVESTIGATIONS, DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, BOGALUSA, LOUISIANA

OAT DISEASES IN ARKANSAS, 1947-48

H. R. Rosen

As in 1946, the fall of 1947 was very dry and this had much to do with late planting, poor seed bed preparation, and poor stands. Nevertheless, there was a 5 percent increase in total oat acreage over 1946-47 and a continued shift from spring to winter oats. While the ten-year period, 1937-46, averaged 52 percent spring oat acreage this dropped to 40 percent in 1947, and 33 percent in 1948. In other words, Arkansas oat growers have largely turned to growing winter oats (while materially increasing the total acreage during the past decade), and this shift has probably occasioned a marked change in the kind and prevalence of both nonparasitic and parasitic diseases. However, so far as the general pathology of the crop is concerned, the change in varieties has perhaps as much to do with changes in disease prevalence as the shift from spring to fall planting.

Despite the continued increase in acreage of Victoria derivatives, especially of the variety Traveler, and an increase in Helminthosporium blight, average State yields also continued to increase so that 1948, with an average of 32 bushel per acre, represents a rising peak in increased production in Arkansas which has continued for three consecutive years. The apparent significance of this is that while a number of other States, especially in the Middle West and in the extreme South, were suffering reduced yields as the acreage of Victoria derivatives was materially increased and as Helminthosporium blight became more abundant, Arkansas growers suffered no such losses, seemingly because this disease is not nearly so common or destructive here. The 1948 data on diseases, based in part on a 2,000-mile survey of oat diseases conducted in May and June, is in line with previous findings (PDR 31: 471-475, 1947) relative to the unimportance of Helminthosporium blight compared with anthracnose and Helminthosporium leaf spot in Arkansas.

Anthracnose. 1948 marked the third successive year in which anthracnose (Colletotrichum graminicolum) was very common and probably the most destructive parasitic disease. Not a single oat field was found during the survey that did not show considerable anthracnose. It was found in fields with coarse textured soils as well as fine soil types, on soils seemingly lacking in one or more essential elements as well as on those that were well fertilized. While no correlation has been noted between the types of crops preceding oats and the amount or severity of anthracnose on oats, the greatest damage observed was where winter oats followed corn at the Fruit and Truck Branch Station, Hope, and no fertilizer was applied after removal of the corn crop and prior to the seeding of oats. In this instance it may be that the seemingly greater damage from anthracnose was associated with lack of soil fertil-

ity. Nevertheless, much anthracnose was found in fields that had been well fertilized.

Since there appears to be very little published information about this disease and since a number of inquiries from fellow workers have been received asking for more information, the following notes are presented:

A brief account of symptoms on seedlings and on plants approaching maturity has been presented previously (PDR 30: 364-368, and 31: 471-475). While seedling symptoms and those of fully headed or maturing plants are often difficult to identify with certainty, there is usually no difficulty in identifying anthracnose in the form of a leaf-spotting disease of oats. On sheaths and blades this disease appears as dark brown spots and streaks, varying in size from pin points to large, often elongated spots running up to half or more of the length of the blade, and either narrow, 1-2 mm.-wide streaks, or frequently more or less spindle-shaped or oval spots, usually considerably wider in the middle and often tapering markedly toward the ends. The margins are often slightly darker than the centers, although they are on the average not so well defined as those delimiting Helminthosporium avenae.

On highly susceptible varieties, as Taggart (C.I. 4076-1), there is at times (possibly when soil fertility is low) much yellowing of blades with one or more spots so that the whole leaf dies prematurely although the infected area may be but a small part of the blade. On other varieties, as Lee and Fulwin, under similar conditions of soil fertility, there is usually less general yellowing of the blades, although the number and size of infected areas are not noticeably reduced.

The fungus fruits mainly in the centers of the larger and older spots. The smaller spots rarely show signs of fruiting bodies and are therefore more difficult to identify. In the centers of the larger spots, which are often ash colored, the blackish sclerotoids (presumably immature acervuli) or mature acervuli are linearly arranged between or on the veins and with a hand lens are readily identified by the black, sharp pointed setae on the fully mature acervuli. These setae are easily broken off in handling.

When a spore suspension is atomized on oat seedlings, the pots of plants kept overnight in a moist chamber at temperatures of 21 to 23° C. and then placed on a greenhouse bench, the temperature remaining the same, the first signs of infection appear in about 3 days and at the end of 5 days are usually quite conspicuous. These consist of spots and streaks of grayish collapsed tissue surrounded by yellow or reddish discoloration of adjoining leaf areas. On such varieties as Lee and Markton there is very little browning of tissue and much more collapse of infected areas than appears under field conditions, the symptoms seemingly being highly artificial and not comparable to natural infec-

tions. On Bond, however, there is more brownish discoloration in the infected areas. But even on this variety, there is more grayish collapsed tissue than observed under natural conditions. Fruiting bodies in the form of sclerotoids appear on some of the spots by the fifth day in such artificial inoculations but there are usually no setae observable at that time or for some time later.

Of the varieties of winter oats commonly grown, including the Victoria derivatives Traveler, Victorgrain, Fulgrain, DeSoto, and Stanton, and the Red Rustproof strains Ferguson 922, Appler, Nortex, and New Nortex, all are susceptible although the Red Rustproofs usually show smaller infected areas. There are no known Bond derivatives grown commercially at present (the Bond hybrid, Taggart, has been released this fall and will be grown in limited areas in the southern part of the State) but judging by the behavior of a few such derivatives at the branch experiment stations and at the Main Station, we may expect fully as much anthracnose as is now present or more. Selections have been made which seemingly offer hope of resistance but they have not been thoroughly tested up till now.

As to the amount of damage or reduction in yield due to this disease, there is no good method at hand for evaluating this. Last year a conservative estimate was given as 5 to 10 percent loss (PDR 31: 471-475) and since there was fully as much anthracnose in 1948, the loss this year would not be lower than this.

Leaf spot. As in 1947, Helminthosporium leaf spot (Pyrenophora avenae) seemingly was next in importance among parasitic diseases. It was found in every oat field and on almost every plant examined. In general, spring oats had fewer infected areas per plant than winter oats and among the latter the Victoria derivatives usually were more heavily infected than the Red Rustproofs. However, there appear to be differences in degree of susceptibility among Victoria derivatives and among plants of any one variety, as in Traveler. Such differences may perhaps lend themselves to breeding for resistance and a selection from Traveler has been obtained that showed much less leaf spot in 1948 than the check variety Lee. Much additional evidence is required to prove resistance, especially since British workers have been unable to find any resistant varieties.

Taking the State as a whole an estimated amount of leaf area lost, most of it prior to and during heading, is about 10 to 15 percent. There is no good measure for estimating loss in yield.

Helminthosporium blight. More of this disease (H. sativum var.) was found in 1948 than in the previous year but, with few exceptions, most of the fields of susceptible varieties appeared to suffer less from it than from anthracnose or leaf spot. Thus, while there was an

appreciable amount of blight (as well as anthracnose and leaf spot) on all Victoria derivatives at the Fruit and Truck Branch Station, at Hope, such derivatives yielded as well as or better than varieties such as Taggart which are resistant to blight. The yields in bushels per acre were (average of 4 replicates): Stanton 4, 70.5 bu.; Letoria, 67.5 bu.; Traveler, 65.9 bu.; DeSoto, 65.5 bu.; and Taggart, 64.9 bu. All of the first four are Victoria derivatives. At the main Experiment Station, Fayetteville, the yields of the same varieties were as follows: Traveler, 65.3 bu.; DeSoto, 65.2 bu.; Stanton 4, 64.7 bu.; and Taggart, 54.8 bu. (The difference required for significance at the 5 percent level is 6.03 bu.). At this station there was very little blight on winter oats but almost as much anthracnose and leaf spot as at Hope. These yield data appear to be in line with disease observations, especially in indicating that Helminthosporium blight played a minor role in reducing yields.

Nevertheless, on susceptible varieties of spring oats (a very small acreage) and in a few fields of winter oats where no rotation of crops was practiced, especially in the southern part of the State, there was considerable blight and without much doubt, a marked reduction in yield.

Smuts. (Ustilago spp.) There was an average of about 5 percent smut in the State as a whole. Much more smut appeared on spring oats than on winter oats, although among the latter it was found for the first time on DeSoto and Traveler, varieties that had shown resistance to the older races of both loose and covered smut. All of the smut found on Traveler was of the losse smut type (U. avenae); that on DeSoto was not studied under the microscope.

Crown rust (Puccinia coronata). Less crown rust was found in 1948 than in any previous year recorded. In fact, not a single collection of crown rust on winter oats was obtained from commercial fields in the survey which covered every important oat growing county in the State (some 50-odd in number). All of the collections were confined to the branch experiment stations, the Main Station, and a few commercial fields of spring oats. The complete failure to find any crown rust in commercial fields of winter oats was probably due mainly to two factors, an exceptionally cold March, a relatively dry April, and a very cool first-half of May, and second, the wholesale substitution of resistant varieties, almost wholly Victoria derivatives, for the older susceptible types such as Lee and Winter Turf.

If an heavenly angel had promised just a few years ago that Arkansas growers were to be freed from the scourge of crown rust because of their good works (notwithstanding a few Dixiecrats), he would have received a courteous but skeptical reception. But miracles do happen, and the amount of inoculum in 1948 was so reduced that even on susceptible varieties, used as checks at the experiment stations, there were only small

pockets of crown rust when there should have been at least 80 to 90 percent infection of leaf areas on all plants (the ordinary amount).

Curiously, out of 9 (1948) collections that have thus far been used for the identification of races, 7 infected Bond, indicating that race 45 or an allied race was involved. The two other collections seemingly represented race 1. In the face of this, what is likely to happen in a year favorable to crown rust if we fill the countryside with susceptible Bond derivatives as some States are doing?

Stem rust (Puccinia graminis avenae). While there was almost no stem rust on winter oats, an exceptionally severe epidemic occurred on late-maturing spring oats and reduced the yields of such varieties very materially. However, spring oats as a whole were very poor, largely because of the adverse weather previously noted.

AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF ARKANSAS, FAYETTEVILLE

SMALL GRAIN DISEASES IN KENTUCKY IN 1948

D. A. Reid and L. M. Josephson

The following observations were recorded on the Agricultural Experiment Station Farm at Lexington and on the outlying test fields in Todd County in southwestern Kentucky and in Daviess County in the Ohio River bottom area. These locations represent the three principal small grain growing areas in the State. A few observations were made in commercial fields in these areas and other central and western sections.

Weather conditions were quite different from that in 1947. After a very wet period early in the spring, very little rainfall occurred from wheat heading time until well after harvest.

Barley

Powdery mildew (Erysiphe graminis f. sp. hordei) was again quite prevalent both in the fall and in the spring. At Lexington, the spring infection was not so heavy as in the preceding fall except in early planted fields with very rank growth. Mildew was not general in experimental plots until after heading. Little mildew was present in the fall in the Todd County test field, but it was extremely heavy on susceptible varieties by heading time.

Leaf rust (Puccinia anomala) [P. hordei] was somewhat heavier than in 1947, especially in western Kentucky. Other leaf diseases were present in varying amounts, and were particularly heavy in Todd County. By the middle of May, the nursery in that location was as heavily infected with leaf diseases as ever seen by the writers. It was difficult to identify characterisitc symptoms on many varieties because of the extremely heavy infection. Net blotch (Helminthosporium teres) (Pyrenophora teres), and spot blotch (H. sativum) were particularly severe. No stem rust was found on barley.

The smuts caused considerable loss in many fields. Commercial fields were found with as high as 20 percent covered smut (Ustilago hordei) and several had 5 percent or more. One plot grown from untreated seed on the station farm had nearly 25 percent covered smut. Reports received, as well as field inspections, showed that loose smut (Ustilago nuda) caused more loss than in the past several years. One commercial field had 8 percent of the heads infected and one plot grown from untreated seed at Lexington had nearly 20 percent infected heads. As a result, farmers showed considerable interest this summer in the hot water treatment for seed plots.

Wheat

Leaf rust (Puccinia rubigo-vera var. tritici) was again quite heavy, but in the western part of the State was overshadowed by an extremely heavy epiphytotic of stem rust, (Puccinia graminis var. tritici). By the first of June, all susceptible varieties in the Todd County field were covered with pustules. The heavy damage done by this infection was reflected in test weights ranging from 43 to 50 pounds. Early varieties (Redhart and Purcam) escaped heavy damage. Reports from county agents in that area indicate that much of the wheat was not accepted for milling because of low test weight. While the area affected apparently included most of the western end of the State, the infection in the Ohio River bottom area was somewhat later, and damage was not quite as extreme. The infection in the Central Kentucky (Lexington) area was scattered, light, and late and did no appreciable damage. Test weights from the plots at Lexington were nearly all above 60 pounds and reached the highest average in several years.

Powdery mildew (Erysiphe graminis f. tritici) was quite heavy by heading time at Lexington.

Loose smut (Ustilago tritici) was present in all commercial fields inspected, and varying from a trace to 3 or 4 percent.

Only one reliable report of Hessian fly damage was received this year. There was neither fall nor spring infestation in the Todd County field where spring damage has been so severe the past two years.

Oats

Crown rust (Puccinia coronata) was quite severe in the spring on susceptible fall-sown varieties in the Todd County field and was probably early enough to do some damage. In the central area, infection was rather light and came in too late to do much damage. Only scattered pustules of stem rust were found.

Infection from Helminthosporium victoriae was extremely light in spring oats at Lexington this year compared to the past two years. Susceptible varieties planted from untreated seed had considerable seedling infection, but local infection of the mature plants was light and very little developed except very late in border rows left standing long after ripening. Again, there were no definite cases of infection noted at any location in fall sown oats.

Yields of some spring varieties seeded from both treated (New Improved Ceresan) and untreated seed are as follows:

C.I. No.	Variety	Yield, bu. per acre: Treated Seed	Yield, bu. per acre: Not Treated Seed
2820	Columbia	43.0	45.7
3971	Clinton	42.3	37.6
3991	Osage*	39.4	7.2
3611	Vicland*	34.8	10.7

* Susceptible varieties.

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON

FIFTY-YEAR SURVIVAL OF FLAX FUSARIUM WILT IN THE ABSENCE OF FLAX CULTURE

Byron R. Houston and P. F. Knowles

Flax (Linum usitatissimum L.) culture has become increasingly important during the past five years in the coastal area of San Mateo County, California. Because of the coastal climate, the crop has been grown largely as a spring and summer crop, rather than being grown in the winter as is the practice in the central valleys of the State. The high humidity and rainfall in this coastal region has been conducive to infection of the plants by several flax diseases, such as Botrytis blight (Botrytis cinerea Pers.), pasmo (Sphaerella linicola Wr.), [Mycosphaerella linorum], browning (Polyspora lini Laff.), and anthracnose (Colletotrichum lini Bolley). Fusarium wilt (Fusarium oxysporum f. lini (Bolley) Snyder & Hans.) had not been reported from this area until July, 1948, when a severe infestation of the disease in two fields on the same ranch was called to the attention of the College of Agriculture. The fields in question had not been under cultivation for over 40 years and no flax crop had been grown since 1898, at which time fiber flax was planted. It appears that the wilt organism was introduced at this time, and survived through the 50 intervening years.

The possibility that the organism had been introduced into this field on the seed planted in 1948 was ruled out on the basis of its unequal distribution over the field and the size of the infested areas. Plants were killed after about six inches of growth in uniform areas from 10 to 100 square feet. These spots continued to enlarge throughout the growing period.

The ability of the fungus to survive at such a high level of infestation in the absence of flax culture was found to be due to the presence of a "wild" flax growing in this region. It was found around the margins of the fields in question and in adjacent uncultivated areas. This flax appeared to be either Linum angustifolium, or an escape from the domestic flax planted at the turn of the century and which through natural selection had developed the character for early dehiscence of the capsules. Greenhouse tests in wilt infested soil showed this flax to be susceptible to Fusarium wilt. It appears that the organism was maintained by its late season attack on the "wild" flax which normally matures in July. Because the infection occurred relatively late in the normal growing season of the host, the latter was able to produce sufficient viable seed to maintain itself over the period of years.

Three other diseases, pasmo, browning, and anthracnose were found occurring naturally on the uncultivated flax.

UNIVERSITY OF CALIFORNIA, COLLEGE OF AGRICULTURE, DAVIS

SORGHUM SEED TREATMENT TESTS IN 1948

R. W. Leukel and C. J. Webster

In Volume 31 (December 15, 1947) of the Plant Disease Reporter it was suggested that, in order to be of the greatest benefit, results from tests on seed treatments should be made available to other workers as early as possible. Acting upon this suggestion, the writers present here a brief summary of results from some materials that were included in last year's report,[1] along with results from several new materials.

Seed of Blackhull kafir and Leoti sorgo was dusted with spores of covered kernel smut (Sphacelotheca sorghi), treated with the different materials and tested for germination and smut control much the same as described in last year's report[1]. Field plantings were made at Beltsville, Maryland and at Lincoln, Nebraska. The summarized results are shown in Table 1. Old Phygon was slightly better than the newer Phygon XL in smut control in Leoti, although somewhat less beneficial to emergence. These differences, however, are of doubtful significance. New Improved Ceresan seems to have improved emergence somewhat more than did Ceresan M, while both dusts controlled smut perfectly. Ceresan M slurry seemed to impair emergence in kafir at 20° C. One smutted head was found in the Ceresan M plots but, since this material eliminated smut in Leoti,

[1] Relative effectiveness of certain fungicides as seed protectants and disinfectants. U. S. Bur. Plant Indus., Plant Dis Reptr. 31 (12): 476-478. 1947.

Table 1. Effect of different seed treatments on A, emergence in Blackhull kafir and Leoti sorgo, (1) in temperature chambers in soil 50 percent saturated and kept at 20 or 25° C., and (2) in field plots planted in triplicate at Beltsville, Maryland and in quadruplicate at Lincoln, Nebraska; and B, control of covered kernel smut in the field plots at both stations, 1948.

Seed treatment		Increase or decrease in emergence[a] from treated seed at								Percent smutted heads in field plots at			
		Beltsville in control chambers				Beltsville in field		Lincoln in field		Beltsville		Lincoln	
	Oz. per	kafir		Leoti		kafir	Leoti	kafir	Leoti	kafir	Leoti	kafir	Leoti
Material	bushel	20°C	25°C	20°C	25°C	--	--	--	--	--	--	--	--
N. I. Ceresan	0.5	-6	-4	14	9	13	6	1	11	0	0	0	0
Ceresan M	2	-5	0	8	6	7	8	3	1	0	0	0	C
Spergon	2	5	-1	12	6	17	4	3	12	0	0	0	2.4
Phygon	2	12	-1	22	7	3	4	13	8	0	0	0	.9
Arasan dust	2	12	4	21	9	13	15	0	7	0	7.1	0	4.1
Arasan slurry	2	17	3	22	9	12	5	3	-5	0	9.5	0.8	3.8
Check[b]	-	--	--	--	-	--	--	--	--	45	52.9	40	49.4
Phygon XL[c]	2	4	3	22	4	26	14	11	2	0	0	0	1.6
Panogen[d]	1.5	9	-5	11	1	16	1	9	-1	0	0	0	0
Ceresan M Slurry	0.5	-20	-3	15	4	11	11	10	-4	0	0	0.4	0

[a] Each figure represents the difference between the average percentage of emergence from treated seed and that from untreated seed.

[b] The average percentages of emergence from untreated seed in the 8 columns from left to right are 61, 89, 61, 81, 36, 33, 66, and 68.

[c] This material contains 50% dichloro naphthoquinone, instead of 80% as in old Phygon, and in a more nearly micronized form.

[d] This contains methyl mercury dicyan diamide (1.4% mercury) in an inert organic liquid carrier.

it is probable that this one smutted head was an accident. At Beltsville all the treatments controlled smut perfectly in kafir and, with the exception of the two Arasan treatments, also in Leoti. At Lincoln, smut control in kafir was almost perfect (three smutted heads) but in Leoti only the four mercury treatments eliminated it completely.

Attention is called to the perfect smut control obtained with Panogen, a new liquid mercury seed treatment material of Swedish origin. Its active ingredient is methyl mercury dicyandiamide. It is applied in a mixture of clear inert organic liquids (not a slurry) at the rate of 2 or 3 c.c. per kg., or about 2 or 3 ounces per bushel. This small amount of liquid is mixed with the seed in a specially designed treater after which the seed is bagged and stored without need of drying.

Some rather favorable reports on the performance of this fungicide have been received from several workers, and other experiments with it are in progress in several States. Others may wish to investigate its possibilities.

DIVISION OF CEREAL CROPS AND DISEASES

NEW OR UNUSUAL RECORDS OF PLANT DISEASES

NEW DISEASE IN NEBRASKA ON SUGAR BEETS

By M. L. Schuster and W. W. Ray

Rust caused by Puccinia aristidae Tracy (Puccinia subnitens Diet). was first noticed in Nebraska on sugar beets, Beta vulgaris L, in the Panhandle area in 1947. The aecial stage was found on sugar beets during the last week in May of that year. A trace of the rust was present in the beet fields; one field near Scottsbluff showed about two percent of the plants infected. In 1948 the aecial stage was found in amounts not exceeding a trace.

The uredial and telial stages of the fungus were found to be quite prevalent on saltgrass, Distichlis stricta (Torr.) Rydb. No estimation was made of the percent of saltgrass plants infected. The disease on sugar beets was found in the vicinity of rusted saltgrass.

This rust on beets had been reported previously from Colorado, Kansas, New Mexico, and Utah[1].

NEBRASKA AGRICULTURAL EXPERIMENT STATION, LINCOLN

1 Weiss, Freeman. Check List Revision, The Plant Disease Reporter. 30(8): 304. August 15, 1946.

VERTICILLIUM ALBO-ATRUM ON AVOCADO IN CALIFORNIA

By George A. Zentmyer

During the past year Verticillium albo-atrum Rke. & Bert. has been isolated from a number of avocado trees (Persea americana, P. americana v. drymifolia) showing a severe wilting and "collapse". The disease has been found on avocado trees from two and one-half to 20 years of age, in five counties in southern California, in San Diego, Orange, Los Angeles, Ventura, and Santa Barbara Counties. This is apparently the first report of this fungus on a member of the family Lauraceae.
UNIVERSITY OF CALIFORNIA, CITRUS EXPERIMENT STATION, RIVERSIDE

CHECK LIST REVISION

Freeman Weiss

RANUNCULUS (RANUNCULACEAE)

RANUNCULUS spp., BUTTERCUP. Numerous, mostly perennial herbs, endemic throughout the U. S. in bogs and meadows, sometimes troublesome weeds in grassland and cultivated ground but many of food value to wildlife; also a few introduced spp. grown for ornament. Chief among the latter is R. ASIATICUS L., TURBAN or PERSIAN B. (1); representative native or naturalized spp. are R. ACRIS L., MEADOW B. (2); R.BULBOSUS L. (3); R. DELPHINIFOLIUS Torr., WATER B. (4); R. REPENS L., CREEPING B. (5); R. SEPTENTRIONALIS Poir, SWAMP B. (6); others (7).

Ascochyta infuscans Ell. & Ev., leaf spot. Wis. (7)
Botrytis cinerea Pers. ex Fr., gray mold. Calif. (1). N.Y., Wis. (7)
Cercospora ranunculi Ell. & Holw., leaf spot. Iowa (5) Wis. (6)
Cylindrosporium ficariae Berk., leaf spot. Wash. (7)
Didymaria didyma (Ung.) Pound, leaf spot. Wis. (2); Ill., Mass., Wis. (5); Ind., Iowa, Mich., Miss., N.Y., Wis. (6); also other spp. in this range and Alaska.
Ditylenchus dipsaci (Kuehn) Filip., leaf and stem nematode. Ore.
Doassansia ranunculina J.J.Davis, leaf smut. Ind., Wis. (4)
Entyloma microsporum (Ung.) Schroet., white smut. Ill., Ky., Va. (5); Ill., Ind., Iowa, Wis. (6); also other spp. in this range and Colo.
E. ranunculi (Bon.) Schroet. Ind. (4); Ore., Wash., Wis. (7).
Erysiphe polygoni DC., powdery mildew. Frequent on various spp. in the Eastern and Central States, especially (2), occasionally (4,5); also Miss., Mont., Nev., Wyo. (7)
Fabraea ranunculi (Fr.) Karst., leaf spot. N.Y. (2,7); Wis. (6,7); Calif., Nebr., Alaska (7).
Ovularia decipiens Sacc., leaf spot. N.Y. (2,7); Tex. (5); Wyo. (7)
Peronospora ficariae Tul., downy mildew. Occasional from Mass. to Md., Iowa, and Minn. (2,3,5,6,7); also Calif. (5). The forms on certain hosts are sometimes given specific rank as P. hiemalis Gäum. in Mass. and N.Y. (2); P. pennsylvanica Gäum., in N.Y. (7); P. ranunculi Gäum. in Mass. (3); Mich. (5)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (5,7)
Puccinia andina Diet. & Neger (III), rust. Ill., Ind. (6)
P. eatoniae Arth. var. ranunculi Mains (O,I). Conn. to S.Car., Miss., and N.Dak.; also Calif. and Colo. (7). II and III on Sphenopholis spp.
P. ranunculi Blytt. (III). Ariz., Colo., Utah, Wash., Wyo., Alaska. (7)

RANUNCULUS cont.

P. rubigo-vera (DC.) Wint. (O,I). Wis. to Tex., Calif., and Wash., also Alaska, on various spp. including 2, 5, and 6, and commonly on R. cymbalaria Pursh. The forms on the latter have been distinguished as sp. f. alpina Mains and pucciniellae Mains, with II and III on Hordeum, Puccinielle, and ? Poa.

Pythium spp., root and stem rot. Calif. (1). P. debaryanum Hesse, P. irregulare Buis., and P. ultimum Trow.

Ramularia aequivoca (Ces.) Sacc., leaf spot. Ill., Iowa (5); Wis. (6,7); Ore., Alaska (7). Said to be the conidial stage of Stigmatea ranunculi.

R. ranunculi Pk. Me., N.Y., Vt. (2); Ind., Miss. (6); Ind., Md., N.Y., Vt. (7)

R. ramulularia-lyallii Dearn. & Barth. Wash. (7)

Sclerotinia sclerotiorum (Lib.) DBy., stem rot, wilt. Ariz., Calif. (7)

Sclerotium rolfsii Sacc., stem rot. Calif. (7)

Septocylindrium ranunculi Pk., leaf spot. N.Y. (2); Ill., N.Y., Wash., Wis. (7)

Septoria spp., leaf spot. Variously identified as S. ficarioides Pk. in Nebr. (7); S. polaris Karst. in Wis. (6,7), La., Miss. (7); S. ranunculacearum Lev. in La., Miss.; S. sp. in Pa. (2), Nebr. (7)

Sphaerotheca humuli (DC.) Burr., powdery mildew. Colo. (7)

Stigmatea ranunculi Fr., on leaves. Calif. (7)

Synchytrium anomalum Schroet., leaf gall. Iowa. (7)

S. aureum Schroet. Ill. (5); Calif., Wis. (7)

S. cinnamomeum J.J.Davis. Wis. (6,7)

Urocystis anemones (Pers.) Wint., leaf and stem smut. Ill., Utah, Wyo. (7)

Uromyces alopecuri Seym. (O,I), rust. Colo., Tex. (7)

U. dactylidis Otth. (O,I). Mass. (5)

U. jonesii Pk. (O,I,III). Calif., Colo., Mont., Wyo. (7)

Yellows -- virus (Chlorogenus callistephi var. californicus Holmes, Callistephus virus 1A K.M.Sm.). Calif. (1)

Curly top -- virus (Chlorogenus eutetticola Holmes, Beta virus 1 K.M.Sm.). Tex. (7)

THALICTRUM (RANUNCULACEAE)

THALICTRUM spp., MEADOW-RUE. Perennial herbs in meadows and open woods throughout the Eastern and Central States, also some western or arctic, as T. ALPINUM L. (1), T. DASYCARPUM Fisch. & Lall. (2), T. DICICUM L. (3), T. POLYGAMUM Muhl. (4), others (5); wildlife food plants and sometimes grown for ornament, but T. AQUILEGIFOLIUM L. (6) of Europe and other introduces spp. are more commonly cultivated.

THALICTRUM cont.

Ascochyta clematidina Thuem. f. thalictri J.J.Davis, leaf spot. Wis. (2,3)

Cercospora fingens J.J.Davis, leaf spot. Wis. (2,3); Ill. (5)

Cercosporella filiformis J.J.Davis, leaf spot. Wis. (2)

Cylindrosporium thalictri (Ell. & Ev.) J.J.Davis, leaf spot. Ind., Kans. (2); Wis. (2,3)

Diplodia thalictri Ell. & Dearn., on stems. N.Y. (4)

Entyloma thalictri Schroet., white smut. Ill. (2,5); Wis. (2,3,5); Ind. (3); Conn., N.H. (4)

Erysiphe polygoni DC., powdery mildew. Mass. to Pa., Ill., and N.Dak., usually on (2) and (4), occasionally other spp.

Gloeosporium thalictri J.J.Davis, leaf spot. Wis. (2)

Mycosphaerella thalictri (Ell. & Ev.) Lindau, leaf spot. Wis. (2); N.J., N.Y., Vt. (3); Iowa, N.Y., Wis. (4); Iowa, Pa. (5)

M. fendleri Tracy & Earle, on stems. Colo. (5)

M. punctata Dearn. & House, on stems. N.Y. (4)

Phoma spp., on stems, as P. spermoides Dearn., in N.Y. and Pa. (2); P. thalictrina Sacc. & Malbr. in N. Mex. (2,5); P. nebulosa (Pers. ex Fr.) Berk. in Calif. (5)

Phytophthora thalictri G. W. Wils. & J.J.Davis, downy mildew. Wis. (2,5); Conn., N.Y., Wis. (4)

Puccinia cockerelliana Bethel (0,I), rust. Colo. (5). II and III on Festuca spp.

P. rubigo-vera (DC.) Wint. (0,I). Colo. (1); Northeastern and North Central States to Colo. and Mont. (2,3,4); Mich. (6); also on other spp. in this range and to Calif. and Wash. A number of spp. in this range and to Calif. and Wash. A number of special forms have been described, with II and III commonly on native spp. of Agropyron, Elymus, and Hordeum.

P. septentrionalis Juel (0,I). Alaska (1); ?Calif. (5). II and III on Polygonum viviparum.

Pyrenopeziza thalictri (Pk.) Sacc., on stems. N.Y. (5)

Septoria thalictri Ell. & Ev., leaf spot. Kans. (2). Perhaps the conidial stage of Mycosphaerella thalictri.

Sphaeropsis thalictri Ell. & Fairm., on stems. N.Y. (5)

Tranzschelia pruni-spinosae (Pers.) Diet. (0,I), rust. Colo., Iowa, Kans., Nebr., N.&S.Dak. (2); Ind., Iowa, Pa. (3); Ohio (4). II and III on native Prunus spp.

T. thalictri (Chev.) Diet. (0,III). Eastern and Central States to Miss. (2,3,4); on other spp. to N.Mex., Calif., and Ida.

Urocystis scrosporioides Koern., leaf and stem smut. N.Y. (4); Ariz., Mass., N.Y., Utah (5)

TRAUTVETERIA (RANUNCULACEAE)

TRAUTVETERIA CAROLINENSIS (Walt.) Vail (1) and T. GRANDIS Nutt. (2).

TRAUTVETERIA cont.

Perennial herbs, (1) in the East and South, (2) in the far West; sometimes grown in wild gardens.

Peronospora ficariae Tul., downy mildew. Tenn. (1)
Puccinia pulsatillae Kalchbr. (III), rust. Ida., Ore., Wash. (2)
Septoria trautveteriae Ell. & Ev., leaf spot. W.Va. (1)
Urocystis anemones (Pers.) Wint., leaf and stem smut. Utah. (2)

TROLLIUS (RANUNCULACEAE)

TROLLIUS spp., GLOBEFLOWER. Perennial herbs, as T. ALBIFLORUS (A. Gray) Rydb. (1) in the Rocky Mountain States, T. LAXUS Salisb. (2), in the East; other spp. (3), of Europe or Asia are grown for ornament.

Ascochyta sp., leaf spot. N.Y. (3)
Cylindrosporium montenegrinum Bub., leaf spot. Wyo. (1)
Mycosphaerella hypsicola (Ell. & Ev.) Lindau, on stems. Colo. (1)
Phomopsis trollii Fairm., on stems. N.Y. (3)
Phyllosticta trollii Trail, leaf spot. Wyo. (1)
Urocystis anemones (Pers.) Wint., leaf and stem smut. N.Y. (2); Md. (3)

XANTHORHIZA. See PDR 27: 38. 1943.

RESEDACEAE

RESEDA

RESEDA ODORATA L., MIGNONETTE. Annual or biennial herb of the Mediterranean region, grown in gardens and under glass for fragrant flowers.

Cercospora resedae Fckl., leaf spot. Mass. to Miss., Mo., and Iowa.
Heterodera marioni (Cornu) Goodey, root knot. ?Fla.
Rhizoctonia solani Kuehn, damping off, root rot. Conn., Tex.
Verticillium albo-atrum Reinke & Berth., wilt. N.Y.

RUBIACEAE*

GALIUM

GALIUM spp., BEDSTRAW. One common annual weed, G. APARINE L. (1) and several native perennial herbs of wide distribution in the U.S., as G. BOREALE L. (2), G. CLAYTONI Michx. (3), G. PILOSUM Ait. (4), G. TRIFLORUM Michx. (5), others (6); minor food plants of wildlife; some of the introduced spp. are grown for ornament.

Cercospora galii Ell. & Holw., leaf spot. Iowa, Ore., Wis. (1); N.Y. (3); Ala. (4); Ore., Wis., Alaska (5); Iowa, N.H., Wis. (6)

C. tenuis Pk. N.Y. (4)

Cuscuta cuspidata Engelm., dodder. Tex. (1)

Erysiphe cichoracearum DC., powdery mildew. Frequent on (1) throughout its range; Calif., Mont., Ore. (5); Calif., Pa., Wash. (6)

E. polygoni DC. Kans. (1)

Hainesia borealis Ell. & Ev., on leaves. Ind., Wash. (2). Probably a conidial state of Pseudopeziza repanda.

Hymenula galii Pk., on leaves. N.Y.(2)

Peronospora calotheca DBy., downy mildew. Del. to Fla., Kans., and Wis. (1); Iowa, N.Dak., Wis. (2); Wis. (5,6). The form on (1) is sometimes distinguished as P. aparines (DBy.) Gäum.; on (2) as P. borealis Gäum.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (6)

Physalospora galii Rostr., on stems. N.Mex. (2); Ore. (5)

Placosphaeria punctiformis (Fckl.) Sacc. Conidial stage of the following.

Pseudopeziza repanda (Fr.) Karst., leaf and stem spot. Ore. (1,2); Ill., Iowa, N.Dak., Wis. (2); N.Y., Wis. (3); Conn., Ga. (4); Calif., Ore. (5); Pa., Wis. (6)

Puccinia difformis G.Kunze (O,I,III), rust. Ohio to Kans. and Mont., also Pacific Coast (1).

P. punctata Lk. (O,I,II,III). Calif., Ore., Wash., Wyo.; ?Ill., Mich., Miss., Wis. (1); N.Car. (4); N.Dak.to Calif. and Wash. (5); also on other spp. in this range and to Conn. and Miss.

P. punctata var. troglodytes (Lindr.) Arth. (II,III). Conn. to Mo. and S.Dak.; Wash. (5). O and I unknown.

P. rubefaciens Johans. (III). Wis. to Calif. and Wash.; Alaska (2); Calif. (6)

Pucciniastrum galii (Lk.) E.Fisch. (II,III), rust. N.Y. and Penn. to Wis., Colo., Calif., and Ore. (5). O and I unknown.

Rhabdospora galiorum (Ell.) Dearn. & House, on stems. N.J. (1,6); N.Y. (6)

Septoria aparine Ell. & Kell., on leaves and stems. Kans. (1); Wis. (6)

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* Most of the genera of this family are aborescent and were covered in the first section of this list; see index in PDR 31: 412.

GALIUM cont.

S. cruciatae Rob. & Desm. (S. psilostega Ell. & Mart.), leaf spot. Wis. (1); N.J. (4); Ind., Mich., N.Y., W.Va., Wis. (6)

(Sporonema punctiforme (Fckl.) Hoehn.): Pseudopeziza repanda.

Uromyces galii-californici Linder (II,III), rust. Calif. (6). O and I unknown.

HOUSTONIA (RUBIACEAE)

HOUSTONIA spp., BLUETS. Small, mostly perennial herbs of the Eastern and Southern States, as H. caerulea L. (1), H. LONGIFOLIA Gaertn. (2), H. PURPUREA L. (3), others (4); sometimes grown in wild- and rock-gardens.

Cercospora houstoniae Ell. & Ev., leaf spot. Del. (1)

Peronospora calotheca DBy., downy mildew. Ill. (1)

P. seymourii Burr. Miss. (1); Ala., Ark., Ill., Ind., Iowa, Tex. (4)

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (4)

Septoria sp., leaf spot. Tex. (4)

Puccinia lateritia Berk. & Curt. (III), rust. Tex. (4)

Uromyces houstoniatus [Schw.] Sheldon (O,I), rust. Mass. to Miss., Mo. and Ill. (1); N.Y., Pa., W.Va., Wis. (2); Miss., Tenn., W.Va. (3); Kans.; N.Car., Tex. (4). II and III on Sisyrinchium spp.

U. peckianus Farl. (O,I). Miss. (3,4); Ala., Tex. (4). II and III on Aristida and Distichlis.

MITCHELLA (RUBIACEAE)

MITCHELLA REPENS L., PARTRIDGE-BERRY. Creeping evergreen herb of eastern N.America; a wildlife food plant, sometimes grown in wild gardens and used for ground cover.

Meliola mitchellae Cke., black mildew. Ala., Fla., Miss., Pa.

Microthyrium mitchellae Cke., on leaves. Fla.

Sclerotium rolfsii Sacc., stem rot. Md.

RICHARDIA (RUBIACEAE)

RICHARDIA SCABRA St. Hil., MEXICAN-CLOVER. Annual herb of the Gulf States and tropical America, grown as a cover- and soiling-crop.

Cercospora carveriana Sacc. & D.Sacc. (?C. richardsoniae P.Henn.), leaf spot. Ala.

Fusarium oxysporum Schlecht. f. batatas (Wr.) Snyder & Hansen, in roots and stems. S.Car.

RICHARDIA cont.
Heterodera marioni (Cornu) Goodey, root knot. Fla., Hawaii
Peronospora sp., downy mildew. Fla.
Phyllosticta richardsoniae Ell. & Ev., leaf spot. Ala.
Phytophthora cinnamomi Rands and P. parasitica Dast., root and stem rot. Hawaii.
Rhizoctonia solani Kuehn, root rot. Fla.
Sclerotium rolfsii Sacc., southern blight. Fla.

Spotted wilt -- virus (Lethum australiense Holmes, Lycopersicon virus 3 K.M.Sm.). Hawaii

SARRACENIACEAE

DARLINGTONIA

DARLINGTONIA CALIFORNICA Torr., CALIFORNIA PITCHER-PLANT. Perennial herb of Calif. and Ore.; grown for novelty in gardens and greenhouses.

Mycosphaerella sarraceniae (Schw.) House, leaf spot. Calif.
Septoria darlingtoniae Dearn. & House, leaf spot. Ore. Antedated by S. chrysamphorae Ell. & Ev., apparently a nomen nudum, reported in Calif.; probably the conidial stage of Mycosphaerella s.

SARRACENIA (SARRACENIACEAE)

SARRACENIA spp., PITCHER-PLANT. Perennial herbs of bogs and marshes mostly in the Southeastern and Gulf States but S. PURPUREA L. (1) occurs throughout eastern N. America; others (2); grown in wild gardens and under glass for novelty.

Colletotrichum gloeosporioides Penz., leaf spot. N.J. (1); Tex. (2)
Helminthosporium sarraceniae MacM., secondary leaf spot. Minn. (1)
Mycosphaerella sarraceniae (Schw.) House, leaf spot. Me., Mich., Minn., N.Y., Pa. (1); Ga., Miss., S.Car. (2)
Peckia sarraceniae Pk. & G. & Clint., on leaves. Mich., N.Y. (1)
Pestalotia aquatica Ell. & Ev., secondary leaf spot. Minn. (1); Md., Tex. (2)
Pyrenopeziza atrata (Pers. ex Fr.) Fckl., on leaves. Minn. (1), Fla., Ga. (2)
Pythium graminicola Subr., root rot. N.Car. (2)
Rhizoctonia solani Kuehn, root rot. Tex. (2)
Sclerotium rolfsii Sacc., southern blight. Tex. (2)

SAXIFRAGACEAE

ASTILBE

ASTILBE spp. Perennial herbs, mostly of China and Japan, grown in gardens and as pot plants under glass; also one native sp. in eastern U.S., rarely cultivated.

Erysiphe polygoni DC., powdery mildew. Mass.
Fusarium sp., wilt. Wash.

HEUCHERA (SAXIFRAGACEAE)

HEUCHERA spp., ALUM-ROOT. Native perennial herbs, more frequent in the Western States but several Eastern and Central. H. AMERICANA L. (1) is useful to wildlife; H. SANGUINEA Engelm., CORAL-BELLS (2) is widely grown for ornament; other spp. (3)

Aphelenchoides fragariae (Ritz.-Bos) Christie, leaf nematode. Calif. (2)
Cercospora heucherae Ell. & Martin, leaf spot. Ind., Ohio, Pa., Va., W.Va. (1); Ill., Ind., Iowa Wis. (3)
Colletotrichum heucherae Ell. & Gall. Ill.
Dothidella heucherae Ell. & Ev., on leaves. Wash. (3)
Erysiphe cichoracearum DC., powdery mildew. Calif. (3)
Phyllactinea corylea Pers. ex Karst., powdery mildew. Mont. (3)
Phyllosticta excavata Sacc., leaf spot. Ida., Alaska (3)
Puccinia heucherae (Schw.) Diet. (III), rust. Pa. to N.Car. and S. Dak. (1); Calif. (2); throughout the Western States and Alaska (3)
Pythium hypogynum Middleton and P. ultimum Trow, root rot. ? Mo. (3)
Ramularia mitellae Pk. var. heucherae Dearn., leaf spot. Wash. (3)
Septoria heucherae Pass., leaf spot. Ind. (1)
S. saxifragae Pass. W.Va. (1); Wash. (2)
Sphaerotheca humuli (DC.) Burr., var. fuliginea (Schlecht.) Salm., powdery mildew. Mont., N.Mex. (3)
Urocystis lithophragmae Garrett, leaf and stem smut. Utah (3)

LITHOPHRAGMA (SAXIFRAGACEAE)

LITHOPHRAGMA spp., WOODLAND-STAR. Several small perennial herbs in the far West, sometimes grown in rock gardens.

Puccinia heucherae (Schw.) Diet. (III), rust. Calif., Utah, Wash.
Urocystis lithophragmae Garrett, leaf and stem smut. Utah.

MITELLA (SAXIFRAGACEAE)

MITELLA DIPHYLLA L., BISHOPS-CAP (1), other spp. (2). Woodland perennials, (1) in the Eastern and Central States, others in the far West; sometimes grown in wild gardens.

Cercospora mitellae Hicks. (nom. nud.), leaf spot. Mich. (1)
Phyllosticta mitellae Pk., leaf spot. N.Y., Wis. (1)
Puccinia heucherae (Schw.) Diet. (III), rust. N.Y. to Tenn., Iowa, and Wis. (1); Me. to Minn., also Mont. to Colo., Calif. and Wash. (2)
Ramularia mitellae Pk., leaf spot. Ill., Ind., Mich., N.Y. (1)
Septoria mitellae Ell. & Ev., leaf spot. Mich., Wis. (1)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Wis. (1)

PARNASSIA (SAXIFRAGACEAE)

PARNASSIA CAROLINIANA Michx., GRASS-OF-PARNASSUS (1), other spp. (2). Perennial herbs of wet meadows, widely distributed in the U.S.; several may be grown in wild gardens, (1) is useful to wildlife.

Erysiphe polygoni DC., powdery mildew. N.Y. (1)
Puccinia parnassiae Arth. (III), rust. Utah (2)
P. uliginosa Juel (1), rust. Alaska (2). II and III on Carex spp. in Europe.

SAXIFRAGA (SAXIFRAGACEAE)

SAXIFRAGA spp., SAXIFRAGE. Numerous small herbs, mostly perennial and of alpine habitats, in the far West and North, also many introduced from Europe for use in rock gardens. S. ARGUTA D. Don (1), S. FLAGELLARIS Willd. (2) and S. MERTENSIANA Bong. (3) in the far West or North, and S. PENNSYLVANICA L. (4) and S. VIRGINIENSIS Michx. (5) of the Eastern States, are representative; others (6).

Asteroma saxifragae Ell. & Ev., on leaves. Alaska (6)
Botrytis cinerea Pers. ex Fr., gray mold. Alaska (6)
Cercosporella saxifragae Rostr., leaf spot. Wis. (4)
Dothidella sphaerelloides Dearn., on leaves. Alaska (6)
Laestadia saxifragae Sacc. & Scalia, on leaves. Alaska (6)
Melampsora arctica Rostr. (0,I), rust. Colo. (2), Alaska (6). II and III on Salix spp.
Mycosphaerella sp. (Sphaerella trichophila Karst. f. saxifragae Dearn.), on leaves. Alaska (6)
Phyllosticta saxifragarum Allesch., leaf spot. Wyo. (1)

SAXIFRAGA cont.

Puccinia heucherae (Schw.) Diet. (III), rust. Mont. to N.Mex. and Wash. (1); Ida., Wash., Wyo. (3); N.Y. to Ill. and Minn. (4); Conn. to Md. and Ohio (5); throughout the Western States and Alaska (6).

P. pazsckei Diet. (III). Ida., Mont., Wash. (3)

P. turrita Arth. (III). Colo., Utah (6)

Ramularia sp., leaf spot. Alaska (6)

Septoria albicans Ell. & Ev., leaf spot. Wis. (4)

Sphaerotheca humuli (DC.) Burr., powdery mildew. N.Y. (5); Alaska (6). Also var. fuliginea (Schlecht.) Salm. in Colo. (6); Pa. (5); Wyo. (1,6)

TELLIMA (SAXIFRAGACEAE)

TELLIMA GRANDIFLORA (Pursh) Dougl. Perennial herb of the Pacific Coast sometimes grown in wild gardens.

Puccinia heucherae (Schw.) Diet. (III), rust. Calif., Ore., Wash., Alaska.

Sphaerotheca humuli (DC.) Burr. var. fuliginea (Schlecht.) Salm., powdery mildew. Alaska.

TIARELLA (SAXIFRAGACEAE)

TIARELLA CORDIFOLIA L., FOAM-FLOWER (1) other spp. (2). Perennial woodland herbs, (1) in the Eastern and Central States, others in the Pacific Coast States or introduced; sometimes grown in wildgardens.

Puccinia heucherae (Schw.) Diet. (III), rust. Conn. to N.Car. and Tenn., also Colo., Mich., Wis. (1); Calif., Ida., Mont., Ore., Wash., Alaska (2).

Sphaerotheca humuli var. fuliginea (Schelcht.) Salm., powdery mildew. Alaska (2).

SCROPHULARIACEAE

ANTIRRHINUM

ANTIRRHINUM MAJUS L., SNAPDRAGON (1). Perennial herb of the Mediterranean region, widely grown for ornament, in the open as an annual and under glass for cut flowers.

ANTIRRHINUM cont.

Agrobacterium tumefaciens (E.F.Sm. & Town.), crown gall. N.Y.

Botrytis cinerea Pers. ex Fr., gray-mold blight (leaves, stems, and blossoms). Cosmopolitan in greenhouses.

Colletotrichum antirrhini Stewart, anthracnose. General in the Eastern and Southern States to Colo. and Tex.

Cuscuta sp., dodder. Wash.

Fusarium sp., stem rot, wilt (? secondary). Conn., Fla., Ga., Okla., Tenn., Wash., P.R.

Heterodera marioni (Cornu) Goodey, root knot. General in the South from Md. to Fla., Tex., and Calif.; also in the North in greenhouses.

Myrothecium roridum Tode ex Fr., stem rot. Tex.

Oidium sp., powdery mildew. Mass., N.Y., Pa.

Peronospora antirrhini Schroet., downy mildew. Calif., Okla., Ore., Pa.

Phoma sp., stem rot. Conn., Ind., Mass., Mich., N.Y., Ohio., Va. Probably stem infection by Phyllosticta antirrhini, q.v. Also reported as P. oleracea var. antirrhini Sacc. in Pa.

Phyllosticta antirrhini Syd., leaf spot, stem rot, canker. General in the Eastern and North Central States, also Tex. and Wash.

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.

Phytophthora cactorum (Leb. & Cohn) Schroet., stem rot., wilt. Calif., Ill., Minn., N.J., N.Y.

P. cryptogea Pethyb. & Laff. Calif., Okla.

P. parasitica Dast. Hawaii.

Pratylenchus pratensis (DeMan) Filip., root nematode.

Puccinia antirrhini Diet. & Holw. (II,III), rust. General. Also on A. nuttallianum Benth. and A. virga Gray, native annuals of s. Calif. C and I unknown.

Pythium spp., damping off, root rot. Cosmopolitan. The following spp. have been identified in Calif. unless otherwise stated: P. debaryanum Hesse, in N.Dak. and Tex.; P. irregulare Buis., P. mamillatum Meurs, P. pulchrum Mind., P. rostratum Butl., P. ultimum Trow, P. vexans DBy.

Rhizoctonia solani Kuehn, damping off, collar rot. General.

Sclerotinia sclerotiorum (Lib.) DBy., stem rot, wilt. Calif., Ind., Mich., Pa., Tex. S.minor Jagger is also reported in Conn.

Sclerotium rolfsii Sacc. (including reports as S. delphinii Welch), southern blight, stem rot. Calif., Fla., Miss., N.J., N.Y., Tex.

Thielaviopsis basicola (Berk. & Br.) Ferr., root rot. Conn., N.J.

Verticillium albo-atrum Reinke & Berth., wilt. Calif., Conn., Me., Mass., Minn., N.J., N.Y., Pa.

Mosaic -- virus(es). In part Marmor cucumeris Holmes, Cucumis virus 1 K.M.Sm., reported in Fla.; in part unidentified, reported in Kans., N.Y., Ohio, Pa.

ANTIRRHINUM cont.

Experimental infection with the following viruses is reported: alfalfa mosaic, pea mottle, tobacco mosaic.

Ring spot -- unidentified virus. Okla. Experimental infection with tobacco ringspot virus is reported.

Fasciation -- cause unknown, probably genetic. Occasional wherever grown.

Tip blight -- cause unknown. Md., Okla., Va. A similar malady reported in Calif. has been shown to be caused by feeding injury of the aphid Myzus persicae.

CALCEOLARIA (SCROPHULARIACEAE)

CALCEOLARIA spp. (probably mostly C. crenatiflora Cav.), SLIPPERWORT. Perennial herbs, sometimes woody, and a few annuals, of the Pacific Coast region from Mex. to Chile; grown for ornament in the open in warm regions, and especially C. crenatiflora under glass as a pot-plant.

Botrytis cinerea Pers. ex Fr., gray mold. Alaska.

Pythium ultimum Trow and P. mastophorum Drechs., root rot. Calif.

Sclerotinia sclerotiorum (Lib.) DBy., stem rot. N.Y., Wash.

Verticillium albo-atrum Reinke & Berth., wilt. N.Y., Wash.

Spotted wilt -- virus (Lethum australiense Holmes, Lycopersicon virus 3 K.M.Sm.). Calif.

Boron deficiency -- discoloration and necrosis of leaves. Calif.

CASTILLEJA (SCROPHULARIACEAE)

CASTILLEJA spp., PAINTED-CUP, INDIAN PAINTBRUSH. Mostly perennial herbs, numerous in the Rocky Mountain and Pacific Coast States, and one common eastward; showy-flowered and useful to wildlife, sometimes transplanted to gardens. C. CALIFORNICA Abrams (1) and C. LINEARIAEFOLIA Benth. (2) are representative of western spp., C. COCCINEA (L.) Spreng. (3) of the East; others (4).

Cercospora sp., leaf spot. Alaska (4)

Cronartium coleosporioides Diet. & Holw. (II,III), rust. Calif. (1); Colo., N.Mex., Utah, Wyo. (2); S.Dak. to Mex., Calif., and Wash. (4). O and I on 2- and 3-needle Pinus spp.

Erysiphe polygoni DC., powdery mildew. Colo., Wash. (4)

Mycosphaerella sp. (Sphaerella vagans Ell. & Ev.), on stems. Colo. (4)

Puccinia andropogonis Schw. var. micropuncta [Ell. & Ev.] Arth. (O,I),

CASTILLEJA cont.

rust. Iowa (3); Wis. to N.Mex., Calif., and Mont. (4). II and III on Andropogon spp.

P. castillejae (Diet. & Holw.) Arth. (II, III). Calif., Utah (4). O and I unknown.

Sphaerotheca humuli (DC.) Burr. var. fuliginea (Schlecht.) Salm., powdery mildew. Colo., Wash., Wis. (4)

CHELONE (SCROPHULARIACEAE)

CHELONE GLABRA L. (1), others (2), TURTLE-HEAD. Perennial herbs mostly in the Eastern and Southeastern States, sometimes grown for ornament and useful to wildlife.

Erysiphe spp., powdery mildew. Reported as E. galeopsidis DC. (= E. cichoracearm ?) in Del., Mich., Miss., N.Y., Ohio, Pa., Wis. (1); N.Car. (2); E. cichoracearum DC. in Ind., Mass. (1); E. polygoni DC. in Mass., Mich., N.Y., Pa. (1). Phyllactinia corylea Pers. ex Karst. is also reported in Ohio (1) but doubtful.

Puccinia andropogonis Schw. var. penstemonis [Schw.] Arth. (O,I), rust. Conn., Mass., N.J., N.Y., Pa. (1); Tenn. (2). II and III on Andropogon spp.

P. chelonis Diet. & Holw. (III), rust. Ore., Wash. (2)

Septoria mariae-wilsonii G.W.Clint., leaf spot. Me. to Pa., Ohio, and Wis. (1).

COLLINSIA (SCROPHULARIACEAE)

COLLINSIA GRANDIFLORA Dougl., BLUE-LIPS (1); C. VERNA Nutt., BLUE-EYED MARY (2); others (3). Annual herbs, mostly in the far West, but (1) is in the Eastern and Central States; grown for ornament and useful to wildlife.

Aecidium insulum Arth. (O,I), rust. Utah (3)

Entyloma collinsiae Harkn., white smut. Ore. (1); Calif. (3)

Puccinia collinsiae [Ell. & Ev.] P.Henn. (O,I,II,III), rust. Calif., Ore., Utah, Wash. (3)

Pythium mamillatum Meurs, root rot. Calif. (3)

Septoria collinsiae H.W.Anders., leaf spot. Ill. (2)

DIGITALIS (SCROPHULARIACEAE)

DIGITALIS PURPUREA L. (1), FOXGLOVE. Biennial herb of Europe, widely grown for ornament; also the source of the drug, digitalis.

DIGITALIS cont.

Colletotrichum fuscum Laub., anthracnose. Conn., Mass., Ore.
Ditylenchus dipsaci (Kuehn) Filip., stem and leaf nematode. Conn.
Fusarium sp., wilt, root rot. Calif., N.H.
Heterodera marioni (Cornu) Goodey, root knot. Calif.
Phyllosticta digitalis Bellynck, leaf spot. N.Y., Tex., Alaska
Ramularia variabilis Fckl., leaf spot. Ore.
Rhizoctonia solani Kuehn, root and stem rot. N.J.
Sclerotinia sclerotiorum (Lib.) DBy., stem rot, wilt. N.Y.
Sclerotium rolfsii Sacc. (S. delphinii Welch), stem rot. Ind., N.J., Tex.
Verticillium albo-atrum Reinke & Berth., wilt. N.Y.

HEBE (SCROPHULARIACEAE)

HEBE spp., as H. ELLIPTICA (Forst. f.)Pennell and H. SPECIOSA (R. Cunn.) Cockayne & Allan. Evergreen shrubs of New Zealand, grown for ornament, chiefly in Calif.

Septoria exotica Speg., leaf spot. Calif.

LINARIA (SCROPHULARIACEAE)

LINARIA CANADENSIS (L.) Dumort., BLUE TOADFLAX (1); L. VULGARIS Hill, BUTTER-AND-EGGS (2); other spp. (3). Annual or biennial herbs, (1) native in N.America; (2) European but widely naturalized, sometimes a weed; useful to wildlife. Other spp., mostly of s. Europe, are grown for ornament.

Aecidium sp. (C,I), rust. Wis. (1)
Alternaria sp., leaf spot. Mich. (2)
Botrytis cinerea Pers. ex Fr., gray mold. Alaska. (3)
Colletotrichum vermicularioides Halst., anthracnose. Mass., N.J., N.Y., Tex., Wis. (2)
Ditylenchus dipsaci (Kuehn) Filip., stem and leaf nematode. N.Y. (1,2)
Entyloma linariae Schroet., white smut. Conn., N.J., Pa. (2)
Erysiphe cichoracearum DC., powdery mildew. Calif. (3)
Heterodera marioni (Cornu) Goodey, root knot. (1,3)
Heterosphaeria linariae (Rabh.) Rehm, (Heteropatella lacera Fckl.) on stems. N.Y. (2)
Peronospora linariae Fckl., downy mildew. Fla., Mass., Okla., Wis. Also reported as P. canadensis Gäum. in Mass.
Phoma linariae Dearn.& House, on stems. N.Y., Tex. (2)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (2,3)
Puccinia antirrhini Diet. & Holw. (II,III), rust. Calif. (3)
Rhizoctonia solani Kuehn, root rot. Ill. (3)

LINARIA cont.

Sclerotinia sclerotiorum (Lib.) DBy., stem rot. Ariz. (3)
Sclerotium rolfsii Sacc., southern blight. Tex. (2)
Septoria linariae Greene, leaf spot. Wis. (1)
Thielaviopsis basicola (Berk. & Br.) Ferr., root rot. Conn. (1)

Yellows -- virus (Chlorogenus callistephi var. californicus Holmes, Callistephus virus 1A K.M.Sm.). Calif. (1,3)

MAURANDIA (SCROPHULARIACEAE)

MAURANDIA ANTIRRHINIFLORA Humb. & Bonpl. in Willd. Perennial vine of Mexico, grown for ornament and naturalized in the Southwest.

Septoria antirrhinorum Tharp, leaf spot. Tex.

MIMULUS (SCROPHULARIACEAE)

MIMULUS spp., MONKEY-FLOWER. Annual or perennial herbs, native in N.America as M. ALATUS Soland. in Ait. (1) and M. RINGENS L. (2); or introduced, as M. LUTEUS L. (3); others (4). Several of the native spp., and especially (3), are grown for ornament or are useful to wildlife.

Botrytis cinerea Pers. ex Fr., gray mold. Alaska (3)
Cercospora mimuli Ell. & Ev., leaf spot. Mo. (1)
Erysiphe cichoracearum DC., powdery mildew. Utah (3); Calif., Pa. (4)
Ramularia mimuli Ell. & Kell., leaf spot. N.Y. (2); Calif. (3); Ohio, Wyo. (4)
Septoria mimuli Ell. & Kell., leaf spot. Ill., Ind., Miss. (1); Pa. to Mo., Nebr., and N.Dak. (2)

Yellows -- virus (Chlorogenus callistephi var. californicus Holmes, Callistephus virus 1A K.M.Sm.) Calif. (4)

ORTHOCARPUS (SCROPHULARIACEAE)

ORTHOCARPUS spp., OWL-CLOVER. Mostly annual herbs of the far West, sometimes grown in wild gardens.

Ascochyta garrettiana Syd., leaf spot. Ore., Utah.
Cronartium coleosporioides (Diet. & Holw.) Arth. (II,III), rust. Colo., Ida., Utah. O and I on Pinus spp.

PEDICULARIS (SCROPHULARIACEAE)

PEDICULARIS spp., WOOD-BETONY, LOUSEWORT. Native perennial herbs widely distributed in N.America, as P. CANADENSIS L. (1), P. LANCEOLATA Michx. (2), other spp. (3) in the far West and North; some are grown in wild gardens or are useful to wildlife.

Cronartium coleosporioides (Diet. & Holw.) Arth. (II,III), rust. Calif., Ida., Mont., N.Mex., Wash. (3)
Mycosphaerella sp. (reported as Sphaerella lineata (Clements) Sacc. & D.Sacc.), on stems. Colo. (3). Perhaps M. pedicularis (Karst.) Lind.
Nectriella pedicularis (Tracy & Earle) Seaver, on stems. Colo. (3).
Phoma coloradensis Tracy & Earle, on stems. Colo. (3). Also Phoma sp., in N.Mex. (3)
Puccinia clintonii Pk. (III), rust. Me., Mich., N.Y., Wis. (1); Colo., Ida., N.Mex., Ore., Wash., Wyo.
P. rufescens Diet. & Holw. (I,III). Colo. (1,3); Calif., Nev. (3)
Ramularia obducens Thuem., leaf spot. Calif. (3)
Sclerotinia coloradensis Cash. & Davidson, on stems. Colo. (3)
Septoria cylindrospora J.J.Davis, leaf spot. Wis. (1)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Ind., Md., Mich., Wis. (2); Calif., Colo., Wyo. (3). Also the var. fuliginea (Schlecht.) Salm., in Minn., Wis. (2); Wyo. (3)
Synchytrium aureum Schroet., leaf gall. Wis. (1)

PENSTEMON (SCROPHULARIACEAE)

PENSTEMON spp., BEARD-TONGUE. Many perennial herbs of prairies, plains, and alpine meadows, widely distributed but most numerous in the far West; many of ornamental value and some are used in rock and wild gardens. P. BARBATUS (Cav.) Roth (1), P. COBAEA Nutt. (2), P. CONFERTUS Dougl. (3), P. GRACILIS Nutt. (4), P. GRANDIFLORUS Nutt. (5), P. HIRSUTUS (L.) Willd. (6); P. SPECTABILIS Thurb. (7) are representative; others (8).

Ascochytella pentstemonis Jenkins, stem spot. Calif. (7). Changed from pentstemonii with approval of author.)
Cercospora pentstemonis Ell. & Kell., leaf spot. Kans., Okla., Tex. (2); Mont. (4); Kans., Nebr., N.&S.Dak., Wis. (5); Ala. (6); Ind., Okla., Wis. (8)
Cercosporella nivosa Ell. & Ev., leaf spot. Colo., Ida., Ohio, Wash. (8)
Coniothyrium pentstemonis Earle, on leaves and stems. Colo. (8)
Erysiphe cichoracearum DC., powdery mildew. Wash. (3)
Heterodera marioni (Cornu) Goodey, root knot.
Kellermannia alpina Ell. & Ev., on stems. Nev. (8)

PENSTEMON cont.

Mycosphaerella pentstemonis Earle, on leaves and stems. Colo. (8). Sphaerella fuscata Ell. is also reported there.

Phyllosticta antirrhini Syd., leaf spot. Ill. (6)

Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (2,8)

Puccinia andropogonis Schw. var. pentstemonis (Schw.) Arth. (O,I), rust. Kans. (2); Iowa, Mo., S.Dak., Wis. (4); Iowa, Kans., Nebr., N.&S.Dak. (5); Ala., Ga., Ill., Ind., Miss., N.Y., Okla., Pa., Wis. (6); on other spp. nearly throughout the U.S. II and III on Andropogon spp.

P. pentstemonis Pk. (III). Utah. (3); Ariz., Calif. (7,8); Ore., Wyo. (8). Correlated with the preceding.

P. confragа Arth. & Cumm. (III). Ariz. (8)

P. palmeri Diet. & Holw. (O,I,III). Ariz., Calif., Ida., Wash. (3); Mont. to N.Mex., Calif., and Wash. (8)

Sclerotium rolfsii Sacc. (S. delphinii Welch), stem rot. Conn., N.J. (1); Tex. (2,8); Ill. (6); Mass., N.J. (8)

Septoria pentstemonis Ell. & Ev., leaf spot. Tex. (2,8); Wash. (3); Ill. (6); Calif., Me., Mich., Miss., Mo., N.Y., Wis. (8)

S. pentstemonicola Ell. & Ev. S.Dak., Wis. (4)

SCROPHULARIA (SCROPHULARIACEAE)

SCROPHULARIA spp., FIGWORT, as S. CALIFORNICA Cham. & Schlecht. (1), S. LANCEOLATA Pursh (2), S. MARILANDICA L. (3). Coarse perennial herbs of wide distribution in the Eastern and Central States (2,3) or far West (1); (3) is sometimes grown as a medicinal plant.

Cylindrosporium scrophulariae Sacc. & Ell., leaf spot. Ill., Okla., Pa. (3)

Coniothyrium scrophulariae (Fckl.) Sacc., on stems. Calif. (1)

Mycosphaerella sp. (Sphaerella decidua Ell. & Kell.), leaf spot. Kans. (3)

Leptosphaeria consessa (Cke. & Ell.) Sacc., on stems. Calif., Ore. (1)

Peronospora sordida Berk. & Br., downy mildew. Calif. (1); Ill., N.Y., Wis. (2); Va. to Kans., Nebr., and Wis. (3)

Septoria scrophulariae Pk., leaf spot. Calif., Ore. (1); N.Y. to Miss., Colo., and Wash. (2,3)

SYNTHYRIS (SCROPHULARIACEAE)

SYNTHYRIS RENIFORMIS (Dougl.) Benth. (1), other spp. (2). Perennial herbs of the Rocky Mountain and Pacific Coast States, sometimes grown in wild gardens.

SYNTHYRIS cont.

Puccinia acrophila Pk. (III), rust. Mont. to Colo. and Utah (2)
P. wulfeniae Diet. & Holw. Calif., Ida., Ore., Wash. (1); Ida., Wash. Wyo. (2)
Ramularia sp., leaf spot. Ore. (2)

TORENIA (SCROPHULARIACEAE)

TORENIA FOURNIERI Lind. Annual herb of China, often grown as a pot plant under glass or in the open in the far South.

Heterodera marioni (Cornu) Goodey, root knot. Md.

VERBASCUM (SCROPHULARIACEAE)

VERBASCUM BLATTARIA L., MOTH MULLEIN (1); V. THAPSUS L., COMMON M. (2); other spp. (3). Coarse perennial herbs of s. Europe and Asia; (1) and especially (2) widely naturalized in the U.S., the latter often a weed but both are useful to wildlife; (1) and others sometimes grown for ornament.

Cercospora verbascicola Ell. & Ev., leaf spot. Tex. (1,2); Ala., Del., Md., Wis. (2)
Erysiphe cichoracearum DC., powdery mildew. Pa. (2)
Heterodera marioni (Cornu) Goodey, root knot. ? Fla.
Mycosphaerella verbascicola (Schw.) Fairm., on leaves. Me., N.Y., N.Car., Pa. (2).
Oidium sp., powdery mildew. N.J. (1)
Peronospora sordida Berk. & Br., downy mildew. N.J. (3)
Phoma spp., on stems. P. thapsi Ell. & Ev. reported in Tex. (1,2), N.J. (2); P. verbascicarpa Fairm. in N.Y. (1); P. verbascicola (Schw.) Cke. = Mycosphaerella v.
Phyllosticta verbascicola Ell. & Kell., leaf spot. Tex. (1,2); Ind., Kans., N.J., N.Y. (2); Wis. (2,3); N.Y. (3)
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (1,2)
Ramularia variabilis Fckl., leaf spot. N.Y. to Miss., Tex., and Wash. (2); Conn. (3)
Septoria verbascicola Berk. & Curt., leaf spot. N.Y. to Ala., Tex., and Mo. (1)

VERONICA (SCROPHULARIACEAE)

VERONICA spp., SPEEDWELL. Numerous annual or perennial herbs, mostly introduced but often widely naturalized and troublesome weeds in lawns and cultivated ground; some are wildlife food plants,

VERONICA cont.

a few are grown for ornament. Common annual weeds are V. ARVENSIS L. (1) and V. PEREGRINA L. (2); perennial weeds are represented by V. OFFICINALIS L. (3) and V. SERPYLLIFOLIA L. (4); V. MARITIMA L. (5) and V. SPICATA L. (6) are cultivated; other spp. (7). For evergreen shrubs sometimes referred to this genus, see Hebe.

Cercospora tortipes J.J.Davis, leaf spot. Wis. (7)
Entyloma veronicae (Wint.) Lagh., leaf smut. Tex. (1,2,3,7); Conn., Ill., Iowa, Kans., Miss., Mo., Wis. (2); Colo., N.Y. (7)
Fusarium sp., root and stem rot. N.J. (5,6)
Gloeosporium veronicae Dearn. & House, leaf spot. N.Y. (3)
Heterodera marioni (Cornu) Goodey, root knot. ? Fla. (2,7)
Peronospora grisea Ung., downy mildew. Ill., Ind., N.Y., Wis. (1); Ga., Ind., Kans., Wis. (2); Calif., Mo., Tex., Wis. (7). The form on (1) is also reported as P. verna Gäum.; as P. aquatica Gäum on V. anagallis-aquatica L.
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex. (1,2,3,7)
Puccinia albulensis Magn. (III), rust. Colo., Mont., Ore., Utah, Wash., Wyo. (7)
P. probabilis Arth. & Cumm. (II,III). N.Mex. (4). O and I unknown.
P. rhaetica E.Fisch (III). Wash. (7)
Ramularia veronicae Fckl., leaf spot. Tex. (1,2,3,7); Okla. (2); Wis. (2,4)
Rhizoctonia solani Kuehn, root and stem rot. Ill., Md. (4)
Sclerotium rolfsii Sacc. (S. delphinii Welch), stem rot. N.J. (3), Conn., Ohio (7)
Septoria veronicae Rob. ex Desm., leaf spot. Mich., Wis. (1); Calif., Fla., Ohio (5,7)
Sorosphaera veronicae Schroet., leaf and stem gall. Miss. (1); Colo. (7)
Sphaerotheca humuli (DC.) Burr. var. humuli (Schlecht.) Salm., powdery mildew. Wis. (4); Conn., Ore. (5)
Synchytrium globosum Schroet., leaf gall. La. (2)

VERONICASTRUM (SCROPHULARIACEAE)

VERONICASTRUM VIRGINICUM (L.) Pennell, CULVER'S-ROOT. Perennial herb of the Eastern and Central States, sometimes grown in wild gardens.

Cercospora leptandrae J.J.Davis, leaf spot. Wis.
Erysiphe cichoracearum DC., powdery mildew. Ill.
Phyllosticta decidua Ell. & Kell., leaf spot. Tex., Wis.
Phymatotrichum omnivorum (Shear) Dug., root rot. Tex.
Puccinia veronicarum DC. (III), rust. Iowa, Tex., Wis.

VERONICASTRUM cont.
Ramularia veronicae Fckl., leaf spot. Tex.
Rhizoctonia solani Kuehn, root and stem rot. Tex.
Septoria veronicae Rob. ex Desm., leaf spot. Wis.
Sphaerotheca humuli (DC.) Burr. var. fuliginea (Schlecht.) Salm., powdery mildew. Conn., Ill., Iowa., Md., Mich., Mo., Wis.

NOTICE REGARDING FURTHER ISSUE OF CHECK LIST REVISION

The preliminary draft of the Check List Revision will be completed in the next issue of the Reporter. As a supplement to this a host index (by genera) will be furnished for the entire List since its inception in April, 1940.

Plans are now being laid for issuing the List in its final form. Because prospective printing funds will not suffice to publish the entire list, estimated to require 750-800 pages at one time, the printed edition will have to be issued in annual sections of 200 to 250 pages. The first of these is scheduled for 1949. It will conform to the Miscellaneous Publication series of the U.S. Department of Agriculture, which is restricted for free distribution to institutions and libraries. It is hoped that the cost of each section of the List can be kept at not over one dollar.

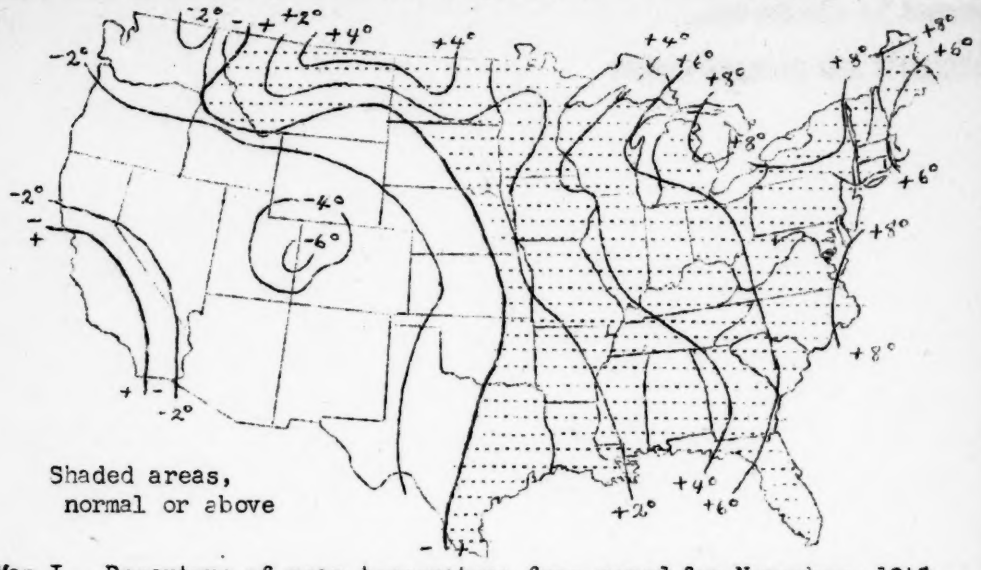
The sequence of hosts in the final List will be uniformly alphabetic, first by plant families, and then by genera within each family. Thus the section to be issued in 1949 will start with Acanthaceae, Aceraceae, etc., and extend to about Liliaceae. Although this arrangement lists the host genera out of alphabetic order (which will, however, be done in the index) it offers the important advantage of grouping related plants, which often have related parasites, together. For the purpose of this List no advantage is seen in arranging the plant families according to natural relationships as is done in most botanical manuals.

A special request is hereby extended to collaborators of the Survey, and to others who are interested in this list, to submit promptly any notes they now have on omissions or errors in the preliminary List pertaining to plant families within the stated range.

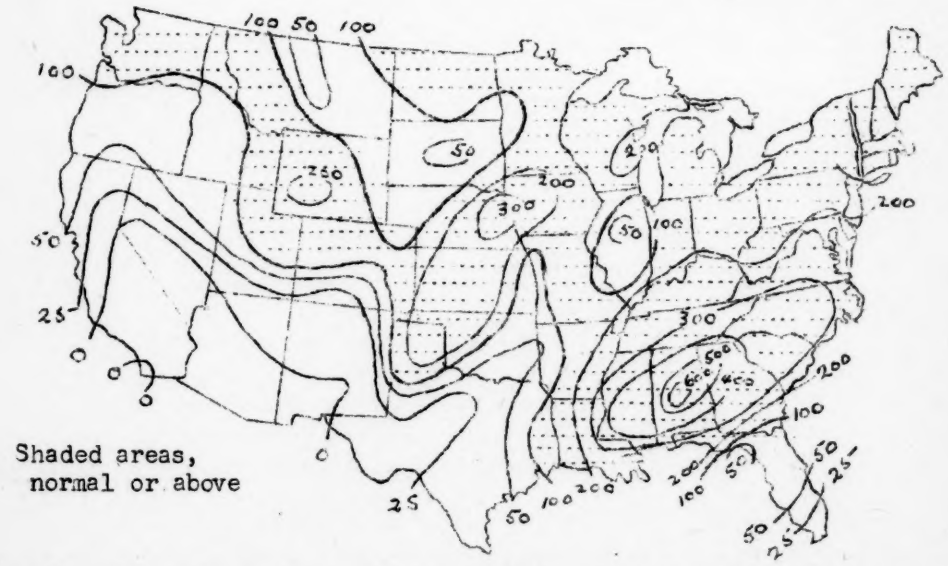
Requests are still received at intervals for previously issued sections of the preliminary list. There is a small stock of separates on hand starting with vol. 30, no. 2 (Febr. 1946) of the Reporter, and continuing to the present. We are unable to furnish most of the sections prior to this date, although several unfilled requests are already on hand. If any of the older sections are now in the hands of persons who do not care to keep a set of the prelinary List, it would be a favor to others

who need the List but have incomplete sets, if these sections were returned to the Survey.

MYCOLOGY AND DISEASE SURVEY



Map I. Departure of mean temperature from normal for November, 1948.



Map II. Percentage of normal precipitation for November, 1948.

NOVEMBER WEATHER

(From U. S. Department of Commerce, Weather Bureau, Weekly Weather and Crop Bulletin for the week ending December 7, 1948).